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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

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VOL. XLIV., No. 7. FRIDAY, FEBRUARY 14, 1908.

The American Railway Association proposes to reduce the per diem rate for interchanged freight cars as soon as possible—that is to say, on March 1—to 25 cents (from 50 cents), and to thereafter fix it at the most equitable figure that can be arrived at through the combined wisdom of five experts. This is the substance of the resolutions providing for a letter ballot, which were adopted at the special meeting called for this purpose and held at Chicago last week. There can be little doubt that the proposition will be adopted. The resolutions are:

> That the question of a change . . . be presented to the members for a letter ballot; the rate to take effect on March 1, if approved by a majority of the membership and two-thirds of the cars owned or controlled . . . The ballot to close on Feb. 25.
>
> That a special commission of five be appointed by the Executive Committee to determine: First, the payment per day which the using road should pay the owning road for the use of its cars; second, an effectual method to secure the enforcement of the existing rules for the return of equipment on demand.
>
> The conclusions of the Commission will be submitted to a letter ballot, and if confirmed will become effective on the first of the month following the announcement of the vote by the Secretary.

This would seem to give due consideration to the needs of the most strenuous objector. The only real remaining ground for dissatisfaction is that the rate will still remain arbitrary, in the sense that it cannot be quickly changed, and that it must be the same everywhere. Moreover, the five commissioners will have to exercise their wills rather than their reasoning powers to settle some of the questions that will come before them. But if they make their report with reasonable celerity it will have to be a decidedly poor one not to merit prompt and universal acceptance; for a code of arbitrary rules, universally applicable, seems at present to be the only practicable way of managing freight car interchange in this great country.

Storing coal under water is admittedly the best way known of minimizing deterioration, as well as of avoiding spontaneous combustion or accidental ignition. The advantages of this method of storage have been determined in Great Britain within the past five years. The British Admiralty has been the most noted as well as the most extensive investigator, although its studies were antedated by individual experimenters, who were able to record definite and conclusive results. The methods and conditions of these experiments and their results were given in English engineering journals and are more or less generally known. But that the idea has been in use in this country since about the time attention was first drawn to it in England may be new to many. In 1902 the Western Electric Company, Chicago, having had much trouble from spontaneous combustion with Illinois coal stored in quantity, determined on water storage as the simplest and most effective preventive. A large hole was dug in the ground, the coal dumped in and flooded. When the large new plant at Hawthorne (Chicago) was built something more than a year ago, the scheme was elaborated to its present proportions. A concrete pit to hold 10,000 tons was built, with tracks across on concrete arches, and alongside, and the reserve supply of coal is kept in the bins thus formed. To deposit the coal in these submerged bins costs about 5 cents a ton. It is removed by a locomotive crane with a grab bucket. The water for the bins comes from the roofs of nearby buildings. The cost of the pit, which is 310 ft. x 114 ft. and 15 ft. deep, was at the rate of $7,000 per 1,000 tons of capacity. When the coal is used it is loaded into cars, allowed to stand 24 hours to drain and then put into the overhead bunkers of the power station, from which it feeds to the stokers. It is therefore used within 48 hours after coming from the pit, and burns well. Since the water removes all of the finely pulverized material, it is equivalent to using washed coal. It will be recalled that the British experiments included storage in both sea and fresh water, and in the former instance the quality of the coal actually was improved, presumably from its permeation by the salt. The effect of salting the water has not been tried at the Western Electric Company's pit.

PENNSYLVANIA RAIL ORDER FOR 1908.

We received news after we went to press last week that the Pennsylvania Railroad, on February 6, placed definite orders with steel manufacturers for 55,000 tons of rail to be delivered during 1908, so that this new order, in addition to 30,000 tons on hand from the 1907 order, will give the company 85,000 tons for use this year, or enough rails to lay some 550 miles—considerably more than the main line distance from New York to Pittsburgh. The orders were distributed as follows: United States Steel Corporation, 27,500 tons; Cambria Steel Co., 11,000 tons; Pennsylvania Steel Co., 11,000 tons; and Lackawanna Steel Company, 5,500 tons. These rails will be rolled under entirely new specifications. In view of the increasing severity of road service and the recognized necessity for

developing an improved rail, the Pennsylvania has for some months been conducting exhaustive examination of the entire art and practice of rail manufacture. A committee of experts representing the railroad and two important steel manufacturers was appointed last summer to make a special study of the subject and the experiments which this committee made were perhaps without precedent in their completeness and in the importance of the scientific data supplied. A new rail section has been developed and we hope to have the opportunity to show this fully in the near future, but the important point for present consideration is the statement in the official announcement that the company places upon the manufacturer the responsibility for the character of the rail produced, recognizing that it is a purchaser and not itself a manufacturer. In all branches of trade it is the privilege of the purchaser to require results. In few or no branches does the purchaser attempt to prescribe the exact way these results shall be obtained. The new Pennsylvania specifications adhere to this excellent principle and allow considerable latitude in the methods of manufacture so long as the result is a sound rail. We have for a long time maintained that exactly this thing should be done; that the burden of proof should be put upon the manufacturer, not upon the user, and that rigorous and exacting test of the finished product will work better than a set of specifications so minute that the manufacturer, once he has complied with them, places himself beyond criticism, whether the result comes up to expectations or not. The Pennsylvania in this instance has devised tests so exacting that it is to the interest of the manufacturers to discard all material which is in any way open to suspicion.

The new specifications do not require any fixed discard, responsibility for this being thrown entirely upon the manufacturer, and they provide that rails shall be free from injurious mechanical defects and flaws, without attempting to describe the particular defects or flaws that will cause the rejection of the rail. In other words, instead of saying to the rail manufacturer, you must make us a rail from ingots which have been cropped to a certain specified per cent., the company in effect says merely, you must make us rails that will not break The methods of testing are very complete, and to place the company's rail practice upon a sound historical basis and to insure that whatever future changes are made shall be based upon accurate data, a system has been devised whereby the history of all rails purchased by the company shall be fully recorded. In order to identify the part of the ingot from which a particular rail was made the new specifications require, in addition to the usual marking, that a letter shall be stamped on each rail to indicate its position in the ingot. A special committee has also been appointed to keep continually in touch with the rail question, in order to enable the company to secure the best rails which at the time of any order it is possible to manufacture. In placing its orders, the Pennsylvania specifically invites the steel manufacturers to fill part of the allotment with open hearth rails in order to ascertain more clearly the actual service differences between open hearth and Bessemer. It is understood that standard prices will prevail.

THE SHADOW IN THE RAILROAD FORECAST.

Under normal conditions a period of financial stress, as affecting especially railroad properties, follows certain fixed lines. Economic theory and practical experience alike confirm them. There is first the antecedent process, often reaching over years of time, of undue expansion. The structure of credit and of business becomes topheavy. Presently some single failure, usually of magnitude, discloses the general condition. Panic and contraction follow next, at first smiting the financial centers, with its familiar symptoms of tight money, hoarding and swift fall of security prices. It hits business next, and the blow deflects instantly upon the railroads. Earnings fall and compel economics, some of them harsh and painful and not always effective enough to prevent reduction of dividends. Next comes the recovery, sometimes slow, sometimes swift. The wreckage is cleared away, credit revives, money rates fall. On the railroads, earnings increase, dividends are reassured, and the crisis passes. Such, in the briefest forms of statement and distilled to its final terms, is the normal story of a panic period. Were external conditions now normal also, one might almost consider our period of trouble over and the railroad situation bright. Indeed, the purely fiscal recovery has been quicker than usual, and the actual wreckage to be cut away less.

But, unfortunately for the railroads, external conditions have been, are, and promise for some time to be abnormal. Heretofore the railroads have been able to work back from hard times not only with a large measure of public sympathy and co-operation, but also under the protection of well defined law. They could rely on a deep and instant public respect for the basic rights of property and, on the other hand, upon statutes which had stood long, which the courts had interpreted and which rested on the precedents of judicial ruling. The deepest shadow on the railroad situation is the change in these respects which has come to pass. During the last year or two railroad statute-making has stretched beyond all bounds. It is not merely that twenty-five or thirty states have passed positively hostile acts, but that the volume of statutes is so vast. They vary in different states and in adjacent states are inconsistent with each other. They impose severe or ridiculous restrictions on railroad operation. The most serious of them veer head-on against the "due process" amendment of the federal constitution, yet even so must travel the long and slow path through the courts that leads to their death, but meanwhile doing their mischief. If unrepealed by legislatures, it would take years for the higher courts to expound the statutes of the last twelvemonth. But, luckily for the railroads, many of the worst of those statutes are of such a character that they tend to repeal themselves, and a second legislature undoes the policies of the first. In federal law, with the statutes less in number and not so complex and contradictory, there is much the same uncertainty as in the states. Hardly a day passes that one does not read of some new question raised under the Sherman Act; and, over all, hangs the doubtful action and attitude of Congress.

A railroad situation is unpleasant when the corporations are mired in such a morass of legislation, federal and state. It is worse when it is up against any unfriendly public sentiment. That sentiment left to itself and to logical outworking would have cleared up soon enough. Reverting again to the rule of experience in such cases, any popular movement against a large vested interest is apt to run to extremes. At first started by discolored abuses, civic feeling goes wild in the effort to check them. Honest men, acting under quick impulse, often join in such a movement. But presently sobriety succeeds rashness. The pocket nerve of communities begins to be touched, the cry of hardship is heard, and the radical turns conservative. But here again we happen now to strike an abnormal condition. From those exalted official quarters whence we should expect the conservative keynote comes instead the word of flame. It is taken up as a countersign by every federal law officer; it stirs up state commissions; it revives the demagogue; it rewakes the anti-corporation spirit of legislatures just beginning to slumber. Shot through it all is "politics" and the issues of personal or party vantage in a presidential campaign near at hand in which corporation questions promise to cut a wide swath; and, if the paradox may be allowed, not a few of the foremost party leaders on both sides vie in striving to prove which party is most like the other. To the railroad manager struggling to make ends meet when engines and empty cars are indefinitely side-tracked, it must be confessed that such a situation is more anomalous than cheering.

Of the final result there can, of course, be no real doubt. The underlying forces of conservatism are too strong and the currents of an enlightened public and personal interest too deep not to prevail at last. But meanwhile the shadow remains and the strange situation presents itself of the great railroad interest of the country in a time of industrial stagnation and distress forced to battle with the law that should protect and with the public sentiment that should be sympathetic and helpful. Years hence, when with a broad and landscape view, the political economist or historian writes up the year 1908, in which the railroad faces the combination of hard times, acute politics, befogged law and federal antagonism, there will be a record to which, in uniqueness at least, the history of other fiscal crises in this country have no parallel. In the story of the nation and its railroads, the year may also be an epoch.

THE WHEEL SITUATION.

Probably no reader of the *Railroad Gazette* can recollect the time when the car wheel of the former day was not better in remembrance than that of the present, and yet the oldest inhabitant would not claim that the first wheel was the best wheel ever made; hence at some time there must have been an improvement of quality. The difficulty is that there is no standard of quality with which to make comparisons, since the standard of life and wear becomes utterly worthless because of the changed conditions of service then and now.

In fact, it is only within the past few years that there has been a wheel question as we understand it to-day. It was about

six years ago, when cars of 100,000 pounds capacity, had become plentiful enough to be a factor in railroad operation, that indefinite rumors floated into the office of the *Railroad Gazette* to the effect that there was trouble with the wheel. A representative was accordingly sent to enquire, and he found a condition of anxiety in the minds of thoughtful railroad men that would have been panicky with people of smaller caliber. Wheels were breaking in unprecedented numbers under high capacity cars, especially upon mountain divisions, where there were long and heavy brake applications, and users and makers found themselves face to face with the problem of improving the wheel or abandoning the high capacity car. By an increase of weight and a change in material a better wheel was produced, and a year later these same officials were breathing easier, but they by no means considered that their troubles were at an end. Since that time, the increase in the relative number of high capacity cars has increased the actual number of failures in proportion, and the weakness of wheels, as evidenced in flange breakages, has become one of the vital questions of the hour.

Meanwhile, the wheelmakers are insistent that if the railroads would only pay more for their wheels, better work could be produced. The railroad replies to this, in substance: "You come here and offer a wheel of a certain weight at a given price and guarantee it to render a certain service. If you can make a better proposition, whereby, by paying more, a better wheel and a better guarantee can be obtained, accompanied by a lower cost per 1,000 miles, we will certainly be willing to entertain it." The burden of producing a better and more economical wheel is thus thrown upon the shoulders of the makers. The relations between them and the railroad companies is one that is purely commercial, and it is left to the seller to prove that he can make a cheaper wheel than the one now in use, the word cheaper being used in the sense of a lower ultimate, not of a lower first, cost. Whether this can be done or not remains to be seen, but an outsider would be led to infer that, in the opinion of the users, it cannot be done, if he based that opinion solely upon the external evidence of the action of the Master Car Builders' Association during the past two or three years. Apparently the members of that association have come to the conclusion that the cast iron wheel of the standard contour is insufficient to meet the requirements of the car of 100,000 pounds capacity, and so they have set themselves to work to improve the wheel, not by improving the material of which it is made, but by strengthening the finished article, by increasing its weight and thickness, using the existing grades of iron. In all the reports of the wheel committees and in all the discussion upon the floor of the conventions, there is not one word or hint that an attempt at improvement of material should be made or that it could successfully be made, as a means of strengthening the wheel. It is, apparently, resignedly accepted that the best that can be done along those lines has been done. Wheel users have accepted the metal as it stands and propose to make the best of it.

The result of this position has been the designing of wheels in which there is a progressive thickening of the metal and a corresponding increase of the weight of the wheel as the service rises from that of a 60,000 pound capacity car, through 80,000 pounds to 100,000 pounds.

This is official action, with no official comment other than the bare statement of the necessity that the wheel that has given satisfactory service under cars of 60,000 pounds capacity must be improved if it is to be used under those of 100,000 lbs. capacity.

The whole situation is not defined, however, in official action though it may be, in part, indicated. We have the private expressions of opinion of superintendents of motive power and master car builders, the so-called piazza talk of the conventions, the general gossip that is floating about from untraceable sources, and the discussions at the railroad clubs. As for the position of those men in charge of the rolling stock, it is well within bounds to say that it averages one of anxiety, especially where work has to be done on mountain divisions, while the feeling that there must be eternal watchfulness of the most wide-awake character is universal, in order that flange breakage—that dreaded result—arising from those insidious and non-detectable cracks that are apt to be set up in the interior of the wheel, may be avoided. The general gossip merely confirms this fear of cracks, and solidifies the current impression that the cast iron wheel is not just the thing—not quite safe for use under high capacity cars. As for the club discussions, the case seems to be merely emphasized by them. Two such discussions have taken place this winter, both marked by a practical unanimity of opinion upon the cast iron wheel question. At the Pittsburgh club, in November, there was an address in which the speaker opened with a well-deserved tribute to the cast iron wheel, and an acknowledgment of what American railroad development owed to it, but he followed this by a very vigorous and emphatic attack upon its use under high capacity cars, arguing that it was not safe. This in Pittsburgh, where the cast iron wheel is at home.

Yet, though the speaker was warned in advance that if he attacked the cast iron wheels he must expect a vigorous defense and counter-attack and be prepared therefor, he found himself in the midst of a love feast, and even the wheelmakers agreed with almost everything that he said.

Again, in January, at the Western Railway club, a paper was presented in which the causes of failure of the cast iron wheel were set forth with great elaboration. No excuses were offered, and the case was clearly and definitely stated. In the discussion that followed there was at least one vigorous attack upon the use of the wheel under high capacity cars, followed substantially by a corroboration, or at least, by no refutation of the arguments offered to show that the wheel was not safe. These straws are certainly very indicative of the opinions of men who know; for, in both cases, if railroad officers present had held any opinions contrary to those expressed, or if the wheel makers had any figures or arguments to offer to contradict or meet the opinions set forth, these opinions and arguments would undoubtedly have been brought to light.

Now, there must be a reason, or reasons, for all this, and it appears not unlikely that it is founded upon a mixture of knowledge and ignorance. We know that the cast iron wheel gave satisfactory service under cars of 60,000 lbs. capacity, and that when that capacity was raised to 80,000 lbs., the difference in efficiency was not enough to be noticeable, but when the load was made 100,000 lbs., the crash came. That much represents knowledge. Then came the talk about inferior wheels, brake action, stresses internal and external, soft and hard chills, and all manner of excuses and guesses, of the validity of which we know nothing. Who knows whether there is really any difference in the hardness of the chill of different wheels? We know that there is a difference in the depth of penetration. But how about actual hardness? How many tests have been made of the strength of the chilled metal cut from wheels? Who has ever measured the internal stresses that exist in the average cast iron wheel as it leaves the annealing pits? Has any one ever attempted to measure the effect of brakeshoe action on these internal stresses? Who knows, except in a general way, the effect of the temperature of the metal at the time of pouring, on the internal stresses of the wheel? In short, do we know one single item of what is going on inside that metal, to give us a clue about what should be done to improve conditions?

Who knows very much about external stresses either? With the exception of the investigations of last summer as recently published in the *Railroad Gazette*, nothing is known of lateral stresses, while of vertical stresses our knowledge is still more limited. It is, as the investigator asserts, a case where the merest scratching has been done on the surface of a field that stands inviting a thorough cultivation with the promise of a rich reward to the cultivator. We have no present opinions to express on this subject; we wish merely to record the apparent conditions; the state of the art. But it is quite proper to suggest to wheel makers and to railroad officers that before there is any further condemnation of the cast iron wheel and before there are any further attempts to improve it, it would be worth while to find out definitely what is the matter with it, and what effect brakeshoe and other actions have upon it. When we have learned this, we will all be in a better position to proceed intelligently with improvements, or at least to decide whether improvement is possible or not.

Probably nobody will deny that the case is serious. That a cure is not yet in sight, is evidenced by the large and increasing percentage of steel wheels that are being put under high capacity cars. It is not reasonable to suppose that railroad managers would buy steel wheels for this purpose, if, by an advance in price, they could obtain a cast iron wheel to meet their requirements. It is not a case of obtaining business through advertising the superiority of their equipment, nor would these same managers consider for a moment a proposition to put steel wheels under 60,000-lb. cars. They simply feel that traffic demands have outgrown the capacity of the cast iron wheel, and they are obliged to use steel just as they did years ago in passenger cars and engine truck wheels.

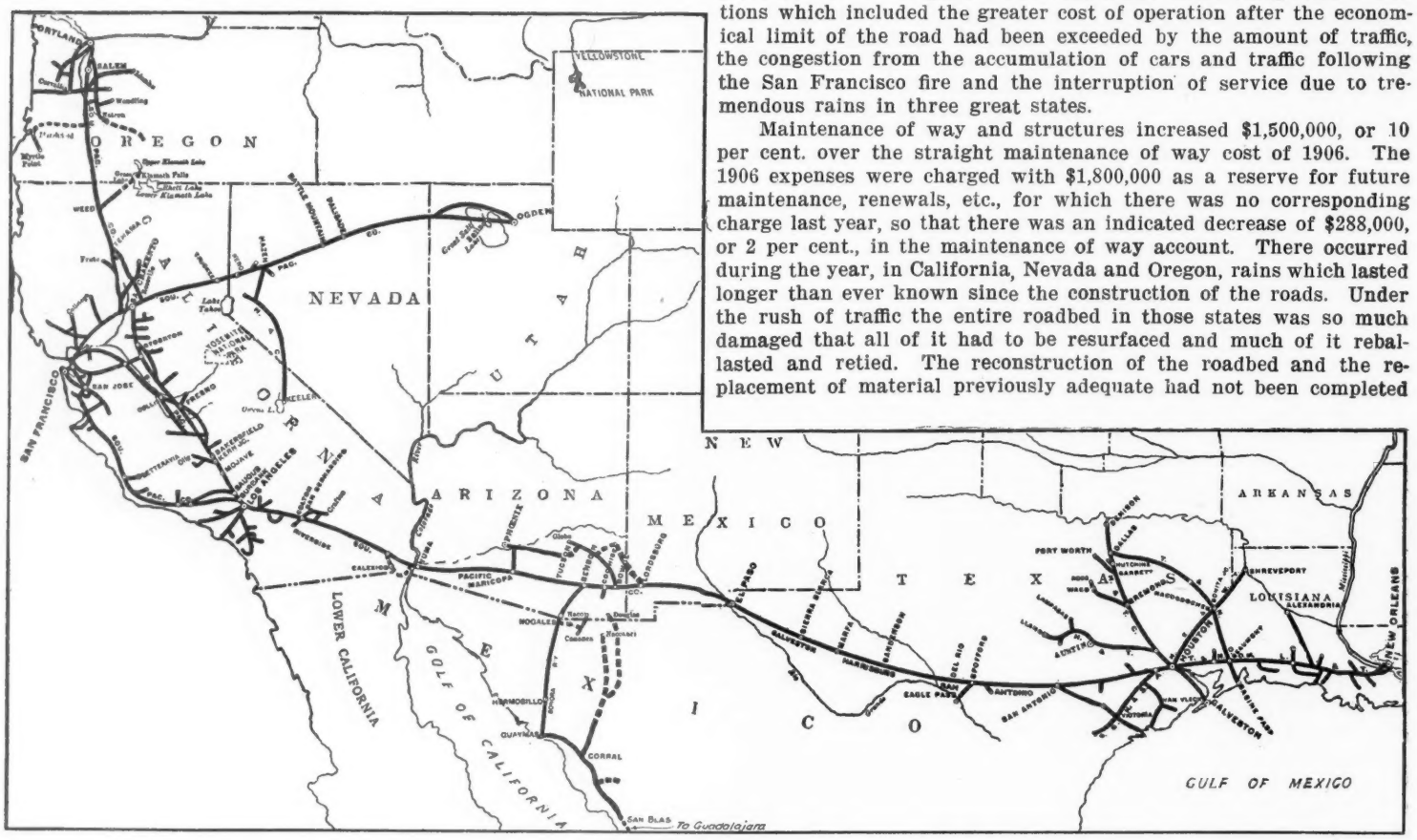
In this there can be no thought of condemnation of the cast iron wheel in itself. At present we know pretty well the extent to which it can be depended upon, but for high capacity service, in

order to bring its quality up to the severe requirements, it is certainly better to pry into the present service condition of the wheel, external and internal, and the causes affecting it, rather than proceed blindly with no definite idea of what ought to be done. What such an investigation will reveal, no one can say, but it is quite safe to predict that until the cast iron wheel is improved along the lines of positive information, the use of its rival, the steel wheel, will continue to increase, and the steel wheel will be placed under a larger and larger proportion of the high capacity freight cars of the country.

For many years the Pullman Company has set the railroads of the country good examples in certain of the details of its dealings with its employees, but in nothing has it done better than in the action reported from Chicago in the following press despatch: "The Pullman Palace Car Company has distributed $174,850 among 3,770 employees of its car service department. The bonus amounts to one month's salary for every conductor and porter who continued on the payroll of the company throughout 1907 and who had no demerits charged against him. The maximum number of porters employed during the year was 4,400, and of conductors, 1,689. It is the intention of the company to grant the bonus of one month's pay each year hereafter to such conductors and porters as make a clean record throughout the year."

Southern Pacific Company.

The twenty-third annual report of the Southern Pacific Company and proprietary companies for the year ended June 30, 1907, was issued on February 6 under date of January 23, 1908. As usual it is a model of completeness; a standard for other companies to follow. Not only is full information given for the holding company, but



Southern Pacific.

most of the important facts are shown in detail for each of the 15 proprietary companies directly included in the system as well as information about four other proprietary companies which are not directly included.

The average mileage of railroad directly operated has risen to 9,400 miles, and the gross transportation receipts from both rail and water lines to just under $125,000,000. The increase in transportation receipts over the year ended June 30, 1906, was $19,300,000, but operating expenses and taxes of all lines increased $12,500,000, leaving net earnings after taxes of $41,800,000 against $35,000,000 in 1906, an increase of $6,800,000. Increases in other income brought up the total amount available to pay fixed charges to $46,800,000, a gain of $8,400,000 over the previous year. Fixed and other charges were $700,000 less and net income $9,000,000 larger than in 1906. From the net income of $28,900,000 there was paid in dividends $13,200,000 and appropriated for betterments and additions or reserved for depreciation of rolling stock, $1,200,000, leaving a surplus for the year after all charges and payments, of $14,400,000. This compares with $11,100,000 in 1906.

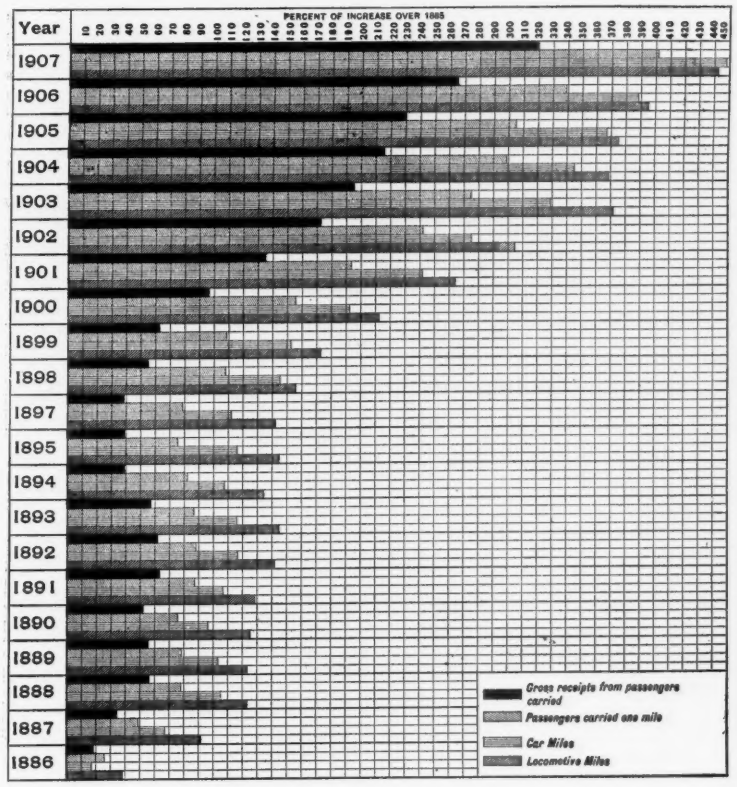
Gross railroad earnings were $117,300,000 against $99,100,000 in 1906, an increase of $18,200,000, or 18 per cent. No other railroad in the country except the Pennsylvania had gross earnings last year of as much as $100,000,000. Gross earnings were $12,481 per mile. Railroad operating expenses increased 17 per cent., leaving net earnings of $43,700,000, an increase of $7,300,000, or 20 per cent. over 1906. Passenger earnings increased 15 per cent. and freight earnings 19 per cent. Meanwhile the operating ratio was reduced from 63.31 in 1906 to 62.75 per cent. last year.

This was accomplished in a year of exceptional difficulties and rapidly increasing costs by spending a smaller proportion of gross earnings on maintenance than in the previous year. Considering maintenance of way and structures and maintenance of equipment as "maintenance," and conducting transportation and general expenses as "operation," there was a great change in the relation of these two groups to the gross receipts. In 1906 almost as large a percentage of gross was spent on one group as on the other, "maintenance" taking 30.88 per cent. of gross and "operation" 32.43 per cent. Last year, however, "maintenance" was reduced to 26.46 per cent. of gross earnings, while "operation" rose to 36.29 per cent.

Operating expenses of all lines increased $12,100,000, or 18 per cent., but the actual increase in the cost of carrying on the business was greater than this, for the expenses of 1906 were charged with $2,100,000 which was credited to a reserve fund for future maintenance and renewals for which there was no necessity last year. The increase in actual operating expenses was, therefore, $14,200,000, or 22 per cent. There were higher wage schedules, most of which went in effect in the fall of 1906; a larger amount of improvements; greater cost of material, principally of lumber and fuel; more traffic moved; and extra expense of moving traffic under exceptional conditions which included the greater cost of operation after the economical limit of the road had been exceeded by the amount of traffic, the congestion from the accumulation of cars and traffic following the San Francisco fire and the interruption of service due to tremendous rains in three great states.

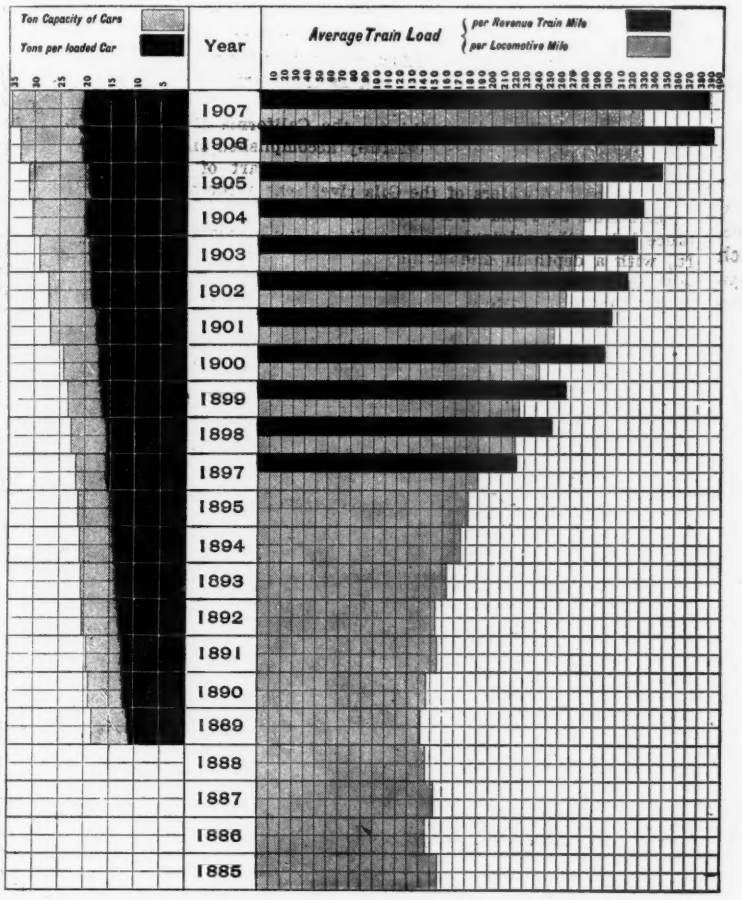
Maintenance of way and structures increased $1,500,000, or 10 per cent. over the straight maintenance of way cost of 1906. The 1906 expenses were charged with $1,800,000 as a reserve for future maintenance, renewals, etc., for which there was no corresponding charge last year, so that there was an indicated decrease of $288,000, or 2 per cent., in the maintenance of way account. There occurred during the year, in California, Nevada and Oregon, rains which lasted longer than ever known since the construction of the roads. Under the rush of traffic the entire roadbed in those states was so much damaged that all of it had to be resurfaced and much of it reballasted and retied. The reconstruction of the roadbed and the replacement of material previously adequate had not been completed at the end of the fiscal year, but has been increasing the expenses of maintenance in the first six months of the current fiscal year. The cost of repairing damages caused by storms and floods on the lines of the Pacific system west of El Paso amounted to $565,000. Repairs of bridges, culverts and trestles increased $458,000, of which $102,000 represents flood damage and the remaining amount includes the cost of 6,900 ft. of steel and the wooden structures replaced. The average cost of ties during the year increased 23 per cent., from 47 cents to 58 cents, so that although there were over 600,000 less ties laid in track, there was an increase in the cost of tie renewals. Repairs of buildings other than docks and wharves increased $695,000, which includes the cost of repairing damages by fire and earthquake at San Francisco and of repairs to the passenger terminals at Oakland and at Alameda Moles. There is also included in main-

tenance of way under a separate account $218,000 spent by the Southern Pacific *Railroad* in finishing the work of moving its tracks and of building about 40 miles of new line higher up on the side of the Salton sink. The expenditures in 1906 for this work amounted to $537,000, making a total of $755,000 in the two years. There were 355 miles of new rails laid, a decrease of 64 miles from 1906. The unit cost of maintenance of way per mile of main and second track (including 175 miles of second track in 1907 and 164 miles in 1906) was $1,676, against $1,744 in 1906.



Passenger Service and Traffic.

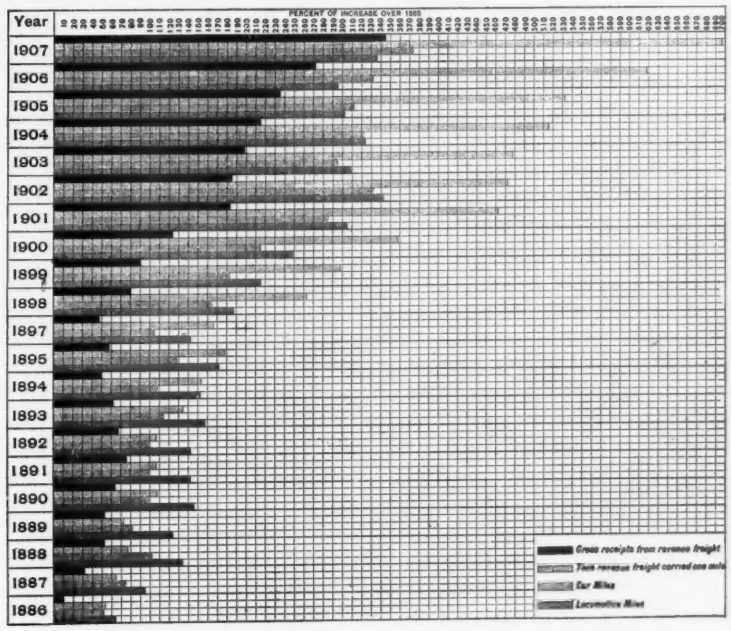
Locomotive miles include revenue passenger train miles, one-fourth of mixed train miles, and helping passenger train miles.



Average Train Load and Tons Per Loaded Car.

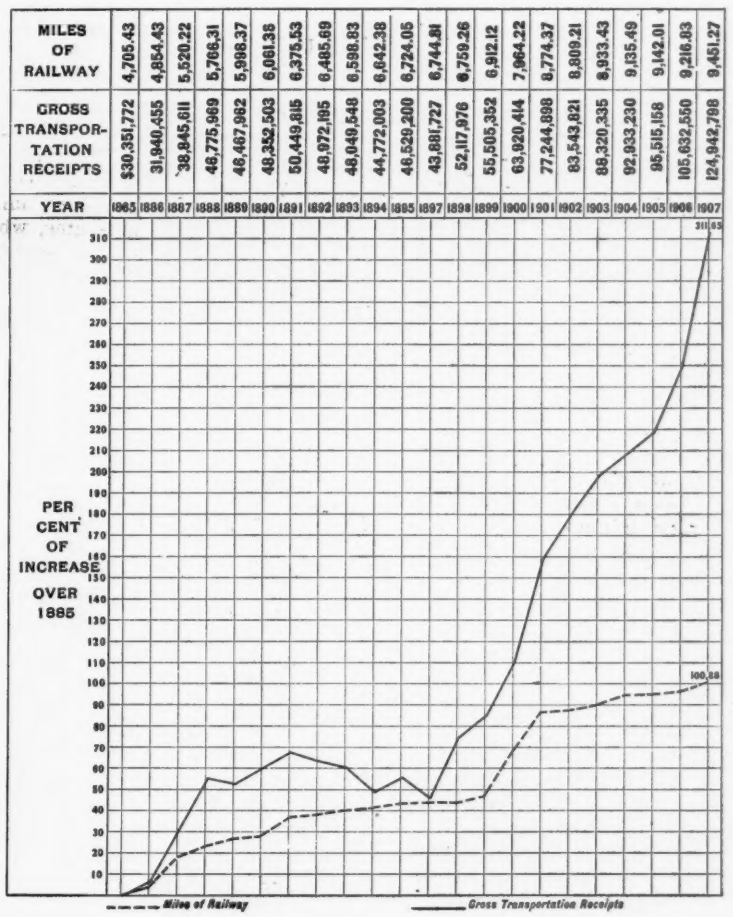
Revenue train miles include miles run with freight trains and three-fourths of mixed train miles. Locomotive miles include revenue freight train miles, three-fourths of mixed train miles, and helping freight train miles.

Maintenance of equipment increased 5 per cent. over the figure for 1906, which included $313,000 charged as reserve for future maintenance, renewals, etc., and 7 per cent. over the straight maintenance of equipment cost of that year. With an increase of 12 per cent. in the locomotive mileage, repairs and renewals of locomotives increased 3 per cent. These expenses include $202,000, the difference between the present cost of replacing 44 old light-weight locomotives and the price received for them, if sold, or the value of the old material, if dismantled. With an increase of 10 per cent. in the miles run by passenger cars, repairs and renewals of passenger-train cars increased 12 per cent. They include $140,000 similarly as with locomotives, on account of replacing 31 passenger-train cars. There was an increase of 11 per cent. in the mileage of cars in freight trains and in the cost of repairs and renewals of freight-train cars. These expenses include $1,137,000 for replacing, as above, 2,518 freight-train cars. Repairs and renewals of road service cars include $67,000 for replacing, as above, 139 cars. The unit maintenance of



Freight Service and Traffic.

Locomotive miles include revenue freight train miles, three-fourths of mixed train miles, and helping freight train miles.



Mileage and Gross Transportation Receipts.

equipment costs and the average number of serviceable locomotives and cars owned per year are shown below:

	Average cost per year.		Av. serviceable No.	
	1907.	1906.	1907.	1906.
Locomotives:				
For repairs and renewals	$3,444	$3,067	.....	.....
For replacements	119	464	.....	.....
Total	$3,563	$3,531	1,692	1,655
Passenger train cars:				
For repairs and renewals	$790	$792	.....	.....
For replacements	82	90	.....	.....
Total	$872	$883	1,700	1,624
Freight train cars:				
For repairs and renewals	$87	$76	.....	.....
For replacements	26	29	.....	.....
Total	$113	$104	43,562	44,172

The great increase in operating expenses came in conducting transportation, where the effect of the unfavorable causes which have already been mentioned was particularly felt. With an increase of 14 per cent. in passenger miles and of 11 per cent. in ton miles the cost of getting and moving the business increased $9,600,000, or 32 per cent. The "total locomotive mileage in service for which the attendant expenses are charged to conducting transportation," increased 12 per cent., while the cost of fuel for locomotives increased 43 per cent. and of locomotive service, other than fuel, 22 per cent. Train service increased 23 per cent. and station and terminal service 26 per cent. As a result of the 50-cent per diem charge and the unusual detention of cars caused by the congestion of traffic throughout the country, payments for car mileage and switching increased from $418,000 in 1906 to $2,156,000 last year, a rise of 415 per cent. The greater cost of handling the business may be briefly and accurately summed up by the statement that the expenses per locomotive mile were 13.353 cents for fuel for locomotives, against 10,475 cents in the preceding year, and for the entire expense of conducting transportation 71.035 cents, against 60.229 cents in 1906. These unfavorable results, it must be remembered, followed a year, in which, with an increase of 8 per cent. in passenger miles and 10 per cent. in ton miles, the cost of conducting transportation was less than in the year 1905.

There was an increase of 36 per cent. in general expenses. Expenses of water lines increased 23 per cent., largely as a result of two additional single trips between New York and New Orleans and 45 additional single trips between New York and Galveston, and the overcrowded dock facilities in New York City.

The trainload on the lines east of El Paso was 346 tons, a decrease of 17 tons, or 5 per cent. from the 1906 figure. West of El Paso the trainload increased 6 tons to 401 tons, making an average for all lines of 380 tons, a decrease of 3 tons. The average loading per loaded car was 20 tons, and the average train had 20 loaded cars. The freight density, including both revenue and company freight, increased from 784,590 tons per mile of road to 848,420, a rise of 8 per cent. The passenger-mile rate, excluding ferry and suburban passengers, was 2.287 cents, an increase of 2 per cent. over 1906, and the ton-mile rate 1.105 cents, an increase of 8 per cent. over 1906. Receipts of passenger trains per revenue train-mile were $1.81, an increase of 6 per cent., and freight trains per revenue train-mile $3.54, an increase of 8 per cent. The train-mileage figures on which each of these results is based include all mixed train miles, but exclude mileage of helping locomotives. Four diagrams, which are given herewith, show by years the growth in mileage, earnings and traffic of the rail and water lines over 1885 (calendar year), the year in which the Southern Pacific Company began operations. The mileage figures show the miles of road in operation at the end of each year.

Six per cent. of the Southern Pacific's tonnage is made up of fruits and vegetables and only 3 per cent. of bituminous coal. Agricultural products make up 20 per cent. of the total, animal products 3 per cent., mineral products 28 per cent., forest products 18 per cent., manufactures 16 per cent., merchandise 12 per cent. and miscellaneous 2 per cent. During the year the proportion of agricultural and mineral products and of manufactures and merchandise increased, while the tonnage of animal and forest products and miscellaneous decreased. The total tonnage of revenue freight was 25,500,000 tons and of company freight 5,300,000 tons.

As on the Union Pacific, separate accounts for betterments and for additions are now kept. The total expenditures last year amounted to $7,600,000, of which $600,000 was paid out of income. There was spent on the lines in Louisiana $927,000, in Texas $444,000 and for the lines west of El Paso and Ogden (Pacific system) $6,300,000, of which $66,000 was spent on the New Mexico & Arizona and the Sonora Railway. One of the most important expenditures, included under additions, is that for signals. On the Pacific system $970,000 was spent during the year. On June 30, 1907, 1,263 miles of these lines were protected by signals and work was in progress or contemplated on 860 miles more. On the eastern lines there was spent $121,000, and 355 miles of lines have, or are shortly to have, signal protection.

Construction work was under way on the date of the report on 15 different new lines. The most far-reaching of these are in Mexico, where a line is now under construction south along the west coast to Guadalajara, 720 miles, and two other lines are being built along the two branches of the Yaqui river, a territory long held in possession by the Yaqui Indians. These northern extensions are shown on the accompanying map; the Guadalajara extension is indicated.

The balance sheet of the Southern Pacific Company and proprietary companies, which excludes all offsetting accounts between the companies and the cost of stocks and bonds owned by the Southern Pacific Company, shows these large construction expenditures. From June 30, 1906, to June 30, 1907, the item "advances for construction and acquisition of new lines, including electric lines in California," increased from $19,200,000 to $39,900,000. This includes the cost of 718 miles of completed railroad and "of work on a part of about 1,700 miles of projected lines," besides 208 miles of finished road in Louisiana and Texas, for which most of the funds were advanced by the Southern Pacific. Cash and cash accounts during the same period decreased from $29,600,000 to $21,600,000, while loans and bills payable increased from $50,000 to $24,700,000. The need for new working capital was met by the issue of $36,000,000 preferred stock, under resolution of the directors of May 9, 1907. This was offered to the stockholders at par and $35,300,000 was subscribed, of which $16,100,000 was paid in by June 30, 1907, and the remaining $19,200,000 has been received since the close of the year. Judging by this showing, the cash assets on June 14, 1907, the day before the first subscription payment on the new issue of preferred stock was due, amounted to only about $5,500,000 against bills payable of probably $24,000,000.

President Harriman describes in some detail the great work which was done in closing the Colorado river crevasse and saving the Imperial valley. This can best be quoted:

> The Colorado river supplies the water for the irrigation of the lands in the Imperial valley. This valley, which is in the southern part of the Salton sink, comprises about 800,000 acres of land as fertile as any in the world, and has a population of about 10,000 persons. Its business is served by a branch line of railroad extending from Old Beach (now Imperial Junction), on the Southern Pacific Railroad, to Calexico, Cal., 41 miles. Work is progressing on an extension of this line from Calexico, through the northern part of Mexico to Yuma, 55 miles, of which 19 miles is completed.
>
> In the spring of 1905 there occurred an enlargement of a small artificial channel, connecting the Colorado river with the California Development Company's canal, which subsequently became the river's low water channel. During a flood stage in November, 1905, the Colorado river made this channel, parts of the Alamo and New rivers, and certain sections of the canal, its main channel. The river, thereupon, flowed inland and discharged into the Salton sink, intead of into the Gulf of California, where its waters had gone for centuries.
>
> The surface area of the Salton sink is about 1,950 square miles and is, at the lowest point, near Salton, about 278 ft. below sea level. The continuous inflow of the river filled up the sink, converting it into a saline lake over 45 miles long and about 15 miles broad, with an extreme depth of about 80 ft. This inflow, unless checked, would ultimately have ruined all improved lands in the Imperial valley as well as the lands along the lower sections of the Colorado river.
>
> After a number of attempts by the California Development Company to close the crevasse, it was successfully accomplished on Nov. 6, 1906. During the last days of November, and the early part of December, 1906, heavy rains on the headwaters of the Gila river sent a further flood, which reached its maximum at Yuma on Dec. 8, 1906, causing a break in the levee some distance below the original break. This rapidly enlarged to a width of 1,100 ft., with a depth in mid-channel of 34 ft., through which the water rushed with a flow of 22,000 seconds-feet back again on its inland course and swept to destruction all before it.
>
> It was believed that the work of closing the new break should be undertaken by the United States Reclamation Service, but, failing in having this done, and having been requested by the President of the United States to close the break at once (provision for the equitable distribution of the burden to be made by Congress), the Southern Pacific Company vigorously commenced operations, and men, material, cars, and locomotives were assembled in order to do this work with the utmost expedition. On Feb. 11, 1907, a little over 15 days from the date of the dumping of the first rock, the break was successfully closed.
>
> In that time, there were put in place about 72,000 cu. yds. of rock, and 5,000 cu. yds. of gravel and clay. In completing the closure and the necessary protection work, the Southern Pacific Company built 2,250 ft. of dam and put in place 80,000 cu. yds. of rock, 80,000 cu. yds. of gravel and 250,000 cu. yds. of earth, a total of 410,000 cu. yds. of material. It also built 15.6 miles of levee, handling in this work 920,000 cu. yds. of earth, and 215,000 cu. yds. of gravel. To handle and place this material 17 miles of standard gage railroad was built.
>
> The company incurred an outlay of $1,489,784 in aiding the California Development Company in its attempt to close the crevasse of the Colorado river, and $1,663,136 in undertaking the work it was requested to do by the President of the United States. The total outlay amounted to $3,152,920.

There was a notable increase in the number of stockholders during the year. On June 30, 1906, the holders of the preferred and common stock numbered 3,910; 18 months later the number was 14,830. With particular reference to the new stockholders a statement is made summarizing the operations of the company for the past 10 years, during which time the average mileage operated has increased from 7,723 miles to 9,401 miles; gross receipts and income from $58,000,000 to $129,900,000; net earnings after

taxes from $21,400,000 to $46,800,000; fixed charges from $15,400,000 to $19,100,000, and surplus after fixed and other charges from $5,900,000 to $27,700,000. Up to the fiscal year 1905 no dividends were paid, so that the surplus after charges was applicable to the improvement of the property.

The table shown at the end of this review sums up, with certain differences necessary to bring the figures in accord with our usual standards, the operations of the company since the payment of dividends has been begun. This shows that dividend payments have risen from $2,800,000 in 1905 to $13,200,000 in 1907. For the year ended June 30, 1908, based on the present amount of stock outstanding at the present rates, the total dividend requirement will be $17,100,000. In this connection it is interesting to observe that the surplus after fixed charges (including improvement appropriations) and preferred dividends amounted last year to 12.6 per cent. on the $198,849,258 common stock outstanding on June 30, 1907. The present annual rate of common dividends, which was begun in October, 1907, is 6 per cent.

The operating and income results of the Southern Pacific Company for the last three years, ended June 30, are shown in the following table:

	1907.	1906.	1905.
Mileage worked	9,401	9,192	9,138
Passenger earnings	$33,636,377	$29,224,510	$26,412,631
Freight earnings	76,506,135	64,122,439	57,902,855
Gross earnings	117,331,812	99,123,550	89,403,632
*Gross earnings	124,942,798	105,632,550	99,515,158
Maint. of way and structures	16,031,877	16,319,831†	13,731,801
Maint. of equipment	15,017,190	14,286,111‡	12,989,732
Conducting transportation	39,238,102	29,683,882	29,691,601
Operating expenses	73,631,374	62,752,771	58,530,015
*Operating expenses	86,220,800	68,120,893	63,664,235
Net earnings	43,700,438	36,370,779	30,873,617
*Net earnings	44,721,998	37,511,656	31,850,923
*Net income	28,911,816	19,913,371	13,124,415
Dividends	13,157,013	7,716,125	2,769,431
§Improvement appropriations	1,220,711	777,502	5,520,386
*Year's surplus	14,408,585	11,118,837	3,426,798

*Including water lines and the Southern Pacific Terminal Company, which owns the Galveston terminals.

†This includes $1,803,813 charged as reserve for future maintenance, renewals, etc.; no similar charge in 1907.

‡This includes $313,474 charged as reserve for future maintenance, renewals, etc.; no similar charge in 1907.

§ Include the following amounts reserved for depreciation of rolling stock owned by Southern Pacific Company and leased to other companies: $609,251 in 1907; $483,793 in 1906; $540,996 in 1905.

NEW PUBLICATIONS.

Specifications and Contracts. By J. A. L. Waddell, C.E., D. Sc., LL. B., and John C. Wait, M.C.E., LL.B. New York: The *Engineering News* Publishing Co., 174 pages; 6 x 9 in. Price, cloth, $1.00.

This book is made up of two lectures, one on specifications and the other on contracts, delivered by Mr. Waddell before the senior class of the Rensselaer Polytechnic Institute, and supplemented with an appendix by Mr. Wait containing Notes on the Law of Contracts. The lecturer apologizes in his opening paragraph for the dryness of his subject and begs for the indulgence of his listeners, and then straightway proceeds to handle it in the most interesting manner and in a way that holds the attention from beginning to end. The whole text of both lectures is indexed by marginal references by which every point is made readily accessible, and the points thus referred to are clearly and concisely set forth. The burden throughout is, Be careful. Know first exactly what it is desired to accomplish and what the parties to the contract wish to agree to, and then express it so clearly that there is no possibility of a misunderstanding in a later interpretation of the document. This excellent advice is followed by driving home the idea that the engineer must above all things be honest with himself, his employer and the contractors with whom he is called upon to deal. But while due importance is put upon the ethical treatment of the subject, it by no means overshadows the purely engineering and commercial features. Then, after touching with clear incisiveness upon the many things that must be taken into consideration in the preparation of specifications, examples of model specifications are given, followed by examples for practice.

The same thoroughness marks the second lecture on contracts, and great attention is paid to the line of demarkation separating them from the specifications proper. There are a multitude of cautions as to what it is essential the contract should contain as well as what is useless and avoidable, and every precaution is taken to warn the unwary against the pitfalls that lie upon all sides of those who have such documents to prepare.

As for the appendix, it will be a remarkably well-informed engineer, or lawyer either, for that matter, who can read it through without finding many things of which he never dreamed, when the laws of liability are expounded. Many a phrase that has been a perfunctory part of contracts from time immemorial is shown to be useless and worthless for the purpose for which it was intended, as it serves, apparently, merely as a sort of bugaboo to those who do not know.

There is the same brief treatment of the headings that is to be found in the lectures, but nothing is slighted or treated cursorily. The book professes to have been prepared for students as a guide to them in the study of the subject, but it can well be made to serve a much broader purpose than that, for there are few engineers who would not find many suggestions in it of great value in the work of preparing specifications and contracts, together with hints about the view the courts will be likely to take of the agreements that they have drawn, as well as hints about the language of the documents themselves.

The Blacksmith's Guide. By J. T. Sallows. The Technical Press, Brattleboro, Vt. 157 pages; 5½ x 7 in.; 161 illustrations. Price, cloth, $1.50; leather, round corners, $2.00.

Once in a while a working book appears that shows all through it that it has been written by a practical man, thoroughly familiar with his subject. That is the case with the book at hand. In his preface the author modestly disclaims to be the only one who knows how to do blacksmithing, and then plunges at once into his work and to the end sticks closely to his text, which, for the most part, is that of telling how particular jobs should be done. He makes no attempts to explain the whys and the wherefores of any of his methods. These he ignores on the general ground that it is needless for the man to know the carbon content of the steel he is handling or the temperature in degrees Fahrenheit to which it should be raised for proper working. "There are books which give this information, which is very useful in its place, but if a spring is brought in for a blacksmith to temper, and he does as I have stated, he will have a position longer than he will by starting out to find the percentage of carbon in the steel and other points that properly concern the scientist."

While the book deals with the details of the manipulation of a multiplicity of jobs, no one of which may come exactly as it is described to the reader, there is an underlying principle in the whole range of the work that is valuable and suggestive and can be utilized by anyone engaged in the same line. The book deals especially with those more delicate branches of blacksmithing in which high grade steels are to be manipulated for tool making and include the forging, hardening and casehardening of the products. The book should be used not only as a reference for the repetition of a piece of work that has been described, but should be carefully read so as not to miss the unexpected suggestions that are frequently made. These suggestions are not grouped but are scattered throughout the work. His explanations for the hardening of tools is particularly explicit and throughout the whole of it the fundamental idea is to get a hard cutting edge backed by a soft, tenacious metal that will have the strength to resist shock, without the brittleness that usually accompanies hardness. Another lesson that is impressed upon the reader is the necessity for a close attention to details. Again and again he emphasizes the importance of points that are apt to be considered of minor importance to the average smith, and insists that success only attends the most careful attention to those details. It is the case of the emphasizing of the value of little things. The book makes no pretense to teach a trade but it cannot fail to be of great value to those who will read it understandingly. It is full of suggestions gleaned from the long practical experience of three generations of blacksmiths.

Bulletins of the Engineering Experiment Station of the University of Illinois.—Bulletin No. 16 briefly presents the results of several years' study of trussed roofs by N. Clifford Ricker, Professor of Architecture. About 50 trusses of a selected type and of different proportions and arrangement were designed in long leaf pine and steel, and were changed until the assumed and actual weights of the trusses agreed. Other trusses were likewise designed in white pine and steel, and a few made entirely of steel. To perform this work as conveniently and as rapidly and accurately as possible, it became necessary to devise simplified formulas, and tables, with a systematic method of treatment, all of which are fully explained in the pamphlet. The results illustrated are mostly shown in graphic tables for ready appreciation. The most important features are a new formula for the weights of trusses; per cent. of weight to be added for connections; most economical ratio of depth to span of truss; distance between trusses; number of purlins per panel, and dimensions of panels. It was found that white pine and steel trusses are about 10 per cent. lighter than those of long leaf pine and steel; also, that if carefully designed, steel trusses from 100 to 200 ft. span have about the same weight as those of white pine and steel. It is believed that this bulletin will be valuable and suggestive to all persons interested in the design and construction of trussed roofs.

Bulletin No. 17 is on "The Weathering of Coal," by S. W. Parr and N. D. Hamilton. It relates to the weathering of coal and losses in fuel values which accompany storage under various conditions. The information heretofore available concerning the behavior of coal in storage is exceedingly meager. The results of tests as outlined in this bulletin, add materially to our information and open a way for a better understanding of matters pertaining to weathering, spontaneous combustion and other difficulties which attend the storage of coal in large masses. Deterioration has been studied

with samples maintained in the open air, under cover at varying temperatures, in air-tight containers, and in submerged conditions.

Bulletin No. 19 is entitled "Comparative Tests of Carbon, Metallized Carbon and Tantalum Filament Lamps," by T. H. Amrine. It gives a comparative study of the electrical characteristics, life, candle-power maintenance, horizontal and vertical distribution and cost of operation of the three most widely used electric lamps under both good and poor conditions of operation. It is based upon a series of tests in which particular attention was paid to obtain exactly similar conditions for the three types of lamps in order to give a fair basis of comparison between types. Comparative rather than absolute results have been sought, though, in almost all cases, dependable quantitive values have been obtained. In an attempt to explain the reason for high efficiency of the newer lamps a study is made of curves plotted between "filament temperatures" and "candle-power per square inch of filament area" and between "watts per candle-power" and "filament temperature." A consideration of these curves leads to the conclusion that the increase in efficiency of the metallized over the carbon filament is due almost equally to higher filament temperature and to selective radiation, while for the tantalum filament it is due almost wholly to higher temperatures.

CONTRIBUTIONS

Cast Iron Car Wheels.

Chicago, Ill., Feb. 8. 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It would seem that certain definite things need to be done before relief can be expected from present cast iron wheel troubles. The real difficulty underlying the whole matter is that not enough is known about the chilled cast iron wheel. In the first place there is no text-book or authoritative data on its manufacture, despite the length of time it has been in use on American railroads; therefore, outside of the experienced wheelmakers few have expert knowledge of the subject. But the really serious question is the ignorance regarding certain essential qualities of the finished wheel, and what the wheel must encounter in service. Not only are the nature and magnitude of the stresses imposed on it under a moving car unknown quantities, but much more needs to be known of its strength to withstand these stresses. The wheelmakers claim that the roads generally seem inclined to consider that the responsibilities for the solution of the chilled wheel problem rests with the makers. From the facts above stated it appears to be a two-part problem, on which each side has a special work to do.

With regard to the manufacturing end: The makers have contended all along that the chilled cast wheel, properly made, is fully equal to present service requirements; but that good wheels cannot be made for the price that the railroads, or many of them, will pay; that the price determines the quality, and for this the railroads solely are responsible. This attitude of the wheelmakers is open to criticism; for although what they allege is largely true, they themselves are not free from blame, since they continue to supply wheels that they know to be of inferior quality and therefore unable to stand the service. When manufacturers contract to supply wheels at a price equal to, or even less than, the price of pig iron, they cannot afford to put much new stock into their product. Cheap wheels presuppose the use of poor stock. But the use of good stock does not by any means assure wheels of corresponding quality, for not only can iron unfit for use be drawn from a cupola in which the best stock has been put, but good iron will make poor wheels if the foundry practice is bad. The liability of internal stresses is minimized only by the most careful foundry practice. The temperature in the cupola and of pouring, the temper of the mold, the time of "shaking out" and of "pitting" are all factors affecting the character of each individual wheel. This is the part of the problem that is the province of the wheelmakers to determine. A careful study of the effects of all of the different variations in cupola and foundry practice, and a determination of the limits for each within which the wheels will be of acceptable quality, should be a matter of record. Much, perhaps all, of this the experienced wheelmaker already knows, but it is not in a form to be of use to any one else.

The railroad's part of the work should be to determine as nearly as possible the service stresses of the wheel, the lowest factor of safety that reasonably can be allowed, and a fair price for wheels having this factor of safety. It doubtless will be said in regard to the first of these that the stresses are indeterminate, and there is no practical way to get at even a fair approximation to them. And, of course, this is unfortunately true at present, but ways may yet be found. Bridge engineers in the past have had to guess at the effect of the impact of moving loads on bridges—and make liberal allowances for it, because they were only guessing; but they seem in a fair way now, after years of empirical formulas, of arriving at accurate determinations of these stresses by practical methods. This problem contained many and serious difficulties, which finally were overcome. The other way may not be any harder to solve.

George L. Fowler said at the January meeting of the Western Railway Club, where certain phases of the cast iron wheel question were discussed (*Railroad Gazette*, Jan. 20), that he hoped to have some data on the stresses imposed on wheels on curves at different speeds for the next M. C. B. convention. As indicative of the excessive loads borne by the wheel when running, some investigations of bolster stresses had revealed impact loads on that member of 25 to 30 per cent. of the static load, at speeds of 25 to 30 m.p.h. Whether the correspondence of impact and speed figures was only a coincidence he was unable to say. This impact occurs about three times a second on a track with staggered joints. As to what portion of the blow to the wheel is absorbed by the intervening bolster springs, Mr. Fowler did not hazard a guess. It is his opinion, though, based on his recent wheel investigations, that wheel flanges get their heaviest blows on tangents, when the car starts nosing, rather than on curves, and this nosing is an important factor in flange breakages. The shorter the distance between truck centers the more severe the effect. It should therefore be the worst on locomotive tenders. It is studies such as Mr. Fowler is making that will finally solve the wheel problem, and the sooner the parties at interest get together to work it out along these lines the sooner their troubles will end.

WESTERNER.

Car Wheel Tests.

TO THE EDITOR OF THE RAILROAD GAZETTE:

New York, Feb. 10, 1908.

The communication in your issue of Feb. 7, from A. T. Perrin in criticism of the results of wheel investigations published under my name, fails at the outset to grasp the situation and the scope of the reports in question. The point is not whether the cast-iron wheel is suited for service on the "ordinary freight rolling stock as in use in this country (England) and the Colonies, and especially for narrow-gage light stock of all type," but whether it is suited for use with the excessively heavy wheel loads obtaining with the cars of 100,000 lbs. capacity in use in the United States where the individual wheel may be called upon to carry a static load of more than 19,000 lbs., which may rise to nearly or quite 30,000 lbs. under the shock of running.

It is quite true that with the ordinary 12-ton wagon, and its insignificant wheel load of 11,200 lbs., no trouble will be experienced. This merely checks with the universal experience in the United States where with cars of 60,000 lbs. capacity and wheel loads of approximately 11,200 lbs., no noticeable trouble has been experienced, and it has been demonstrated beyond all peradventure that the cast-iron wheel is eminently well suited for such purposes. Even when the wheel loads have been raised to 14,500 lbs. as they are under cars of 80,000 lbs. capacity, no noticeable increase of wheel failures occurred, and it was only when these loads were again increased by raising the car capacity to 100,000 lbs. that serious trouble was experienced, and it was on the basis of use under such cars, and such cars only, that a doubt was expressed as to the advisability of using the cast-iron wheel.

In further explanation of the articles in question it may be repeated that they were reprinted from a book of reports of investigations that were not originally intended for publication, but were made, as said in the preface, "for the purpose of securing information regarding the standards of quality of metal and workmanship that must be met in the development of a new industry, the success of which depended on the production of a wheel that would at least meet the present requirements of railroad traffic." It was with the steel-tired wheel that the wheel comparisons were made, and the cast-iron wheel was only brought in incidentally and as an afterthought. And it was not until the stresses put upon wheels under cars of 100,000 lbs. were measured that any actual data was obtained showing that the cast wheel was not suited for that service.

The position, taken by your correspondent is, therefore, unassailable, but it is doubtful if he would care to sign his own letter if "50-ton wagon" were to be written for "12-ton," and "19,500 lbs." for "11,200 lbs.," and "high capacity mineral wagons" for "ordinary freight and narrow-gage light stock." That would put an entirely different aspect on the matter, and one that is based on an experience in the United States that has caused no small amount of anxiety.

GEO. L. FOWLER.

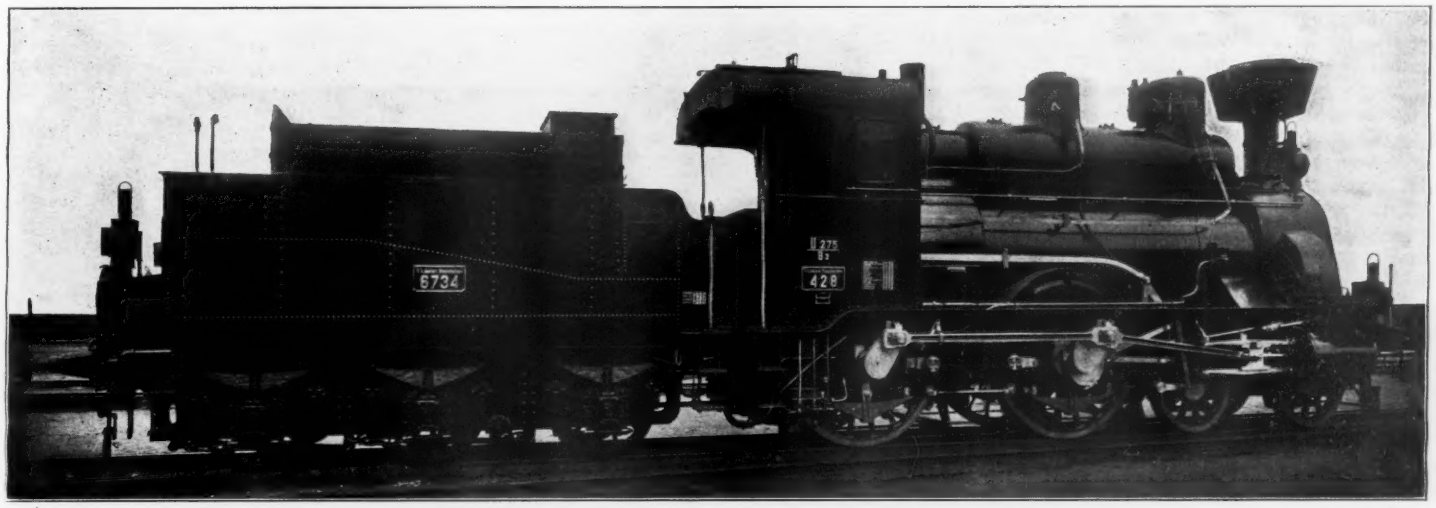
There is an immense traffic in wine on the Italian railroads; but the consignees this year complain bitterly of the "evaporation" from the casks en route. In a single fortnight a Milan firm found one cask with a gimlet hole and 25 gallons short; another with bung out and also 25 gallons short; three broken open with 60 gallons missing, and another which lacked the bung and 20 gallons of wine. These calamities are doubtless due to the failure of the railroads to keep a supply of water on their freight trains. From time immemorial it has been the custom of wagoners hauling wine

into Rome (and doubtless other places) over the Campagna in the heat of the day to take their siesta under the shade of the cask, provided with a gimlet. But they always delivered the casks full, which was easy to do because further on the evaporation could be made good from the aqueducts.

The Brotan Locomotive.

BY WILLIAM C. DREHER.

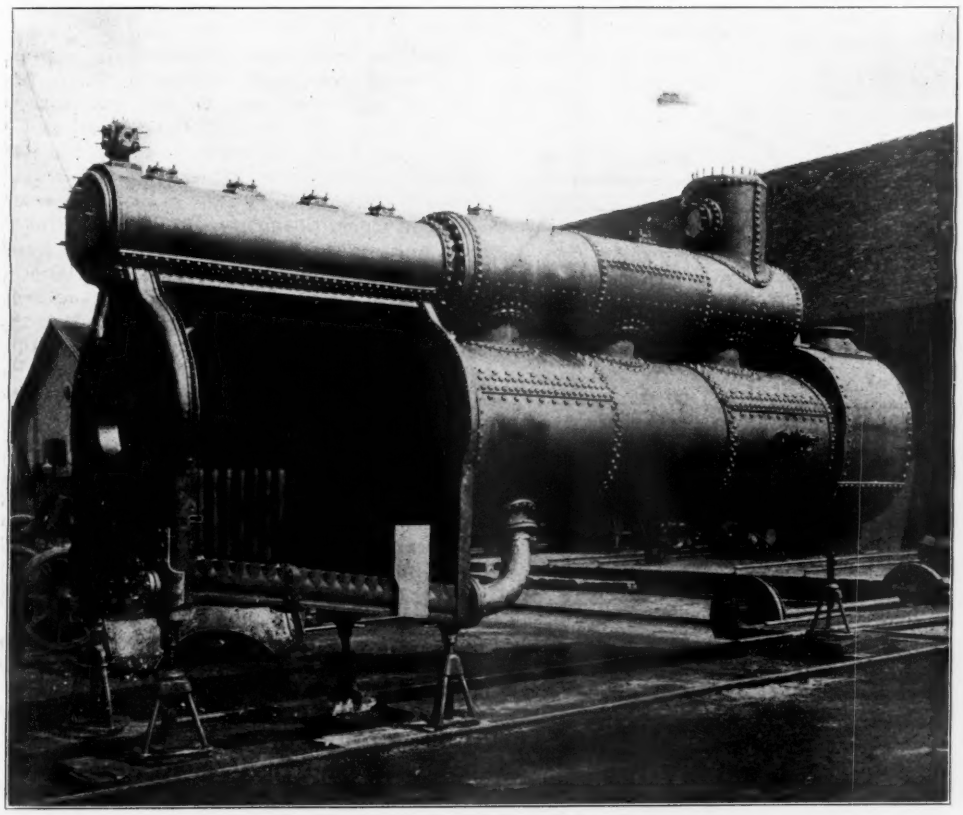
The Brotan locomotive boiler, with a water-tube firebox, has been mentioned occasionally during the last few years in the American technical press; but, so far as I am aware, American readers have not yet had a full description of it, with adequate illustrations, laid before them. It has been advertised to some extent among American locomotive builders and railroad managers, but as the former have been working at their utmost capacity for some years in meeting the demands for locomotives, and the latter have been overwhelmed with larger plans, no attempt has yet been made in America to test the worth of the new boiler.



Passenger Locomotive for Austrian State Railroads, Fitted with Brotan Boiler.

On the Continent, on the other hand, its use is steadily increasing. Twenty-one are already in operation, and 29 more are building. Austria, where the invention originated, is far in the lead of other countries in introducing it. Of the 21 in use, not less than 14 are on Austrian and Hungarian roads, while 17 of the 29 building are for them. The Prussian State Railroads have had two in use for over a year; two are working on Russian roads, and one on the St. Gotthard Railroad in Switzerland. It will soon be practically tested in other countries; four machines are being built for French, two for Belgian, and one for Swedish roads. Switzerland is to take two more and Russia two.

The new boiler is the invention of the engineer, Brotan, of the Imperial Railroad Ministry of Austria, after long study and experiment. It was first put in operation in January, 1901, on one of the Austrian roads, and it immediately established its superiority. In September of that year trial tests were made between the Brotan locomotive and two ordinary ones of about equal load capacity, and it was found that the new boiler consumed 35.8 lbs. of coal per locomotive-mile, as against an average of 49.3 for the other two. The saving of fuel was thus over 27 per cent., or 23.6 per cent. when reckoned on the basis of ton-mileage. In the following month there was a second competition between the Brotan and four other locomotives, including the two of the previous test. This trial showed a saving of 20.7 per cent. on locomotive-miles and 19.5 per cent. on ton-miles in favor of the Brotan locomotive.



Brotan Boiler with Water-Tubes on One Side of Firebox Removed.

If any mechanical engineer were asked what part of the present locomotive boiler stands most in need of improvement, he would answer, without doubt, the water-chambers, or water-legs, that surround the firebox. These are built somewhat differently in Europe from the system in vogue in America, thick sheet copper being used abroad as casings for the firebox; but on both sides of the ocean these water-legs are the weakest and most troublesome part of the locomotive. Their two sides are held together by a great number of stay and anchor bolts to resist the expansive force of the steam and prevent explosions. For all that, it is precisely here that most of the bad boiler explosions occur. The inner heads of the copper bolts are in time consumed by the fire-gases and leaks develop that are difficult to stop. Repairs are usually made by hammering the heads, but this cannot be continued indefinitely; the sheets must in time be completely overhauled or replaced by new ones. Another great trouble with the bolts is that they become centers for the collecting scale; heavy deposits also accumulate in the corners. This not only causes a serious waste of fuel, but a great loss of time and money while the locomotive is undergoing repairs and cleaning at the shops, the entire machine being dead capital pending repairs and cleaning on a small part.

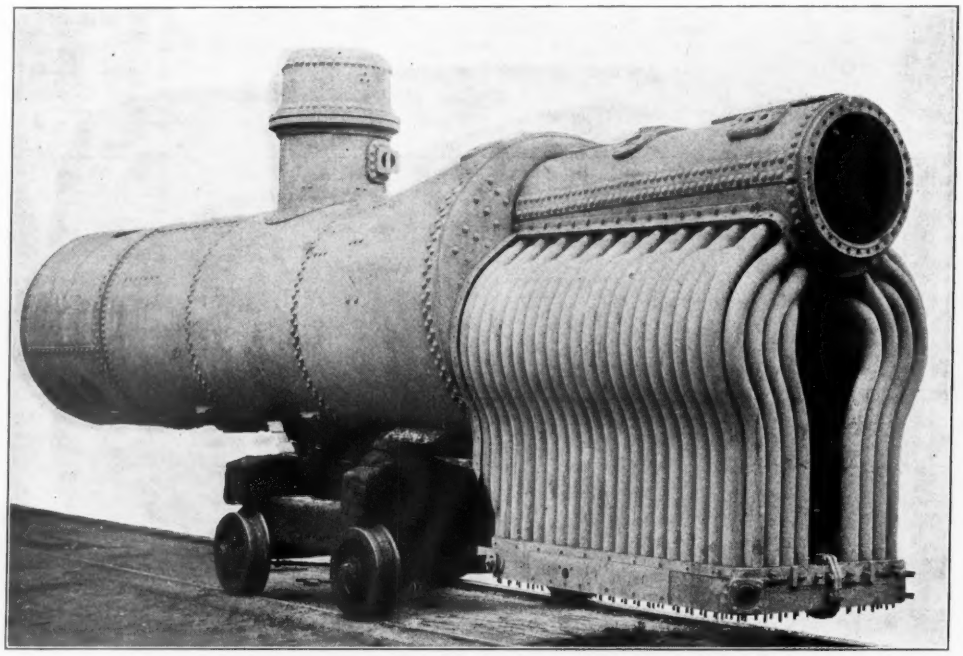
In the Brotan boiler these troublesome water-legs are done away with, and in their stead a system of water-tubes forms the sides and roof of the firebox. These can be made very thin ($^3/_{16}$ in.), so that the water passing through them is exposed immediately to the heat of the firebox. They are of the weldless (Mannesmann) type, are made of mild steel, and have an exterior diameter of about 3¾ in. They are thoroughly annealed and tested to a pressure of 750 to 900 lbs. per sq. in. They are set up in four rows on each side of the firebox and converge in a Gothic arch at the top where they enter the steam-collector. Strips of copper or asbestos are hammered into the spaces between them, so that each row presents an impervious wall to the fire-gases. Between each pair of tubes in

the same row a space of only $^1/_{16}$ in. is left to be thus filled, except at their ends, the tubes being reduced at the top and bottom to about 3 in. diameter, and so leave more space between them. They are made smaller there so as not to weaken too greatly the bottom-pipe and the steam-collector.

The bottom-pipe is of cast-steel, and, except in small locomotives, is cast in two or three sections, because of the difficulty of making perfect castings in a single piece. An American locomotive builder, however, has expressed the opinion that the best American shops can make these pipes of any desired size in a single casting. The ends of each section are flanged so that they can be screwed together steam-tight. Their cross-section has the shape of a broadened letter D, the flat surface of which is set upright and turned away from the firebox. Their round surface is provided with bosses for receiving the fire-bars and ash-pan. The bottom-pipes have an interior diameter of over 6 in. and are connected with the longitudinal boiler by bent pipes. The bottom-pipes and the grate usually slope upward somewhat from the boiler-head, but sometimes they are set horizontal.

As steam is generated in the upright water-tubes, it rises rapidly to the steam-collector, forcing the water along with it. The collector, which is 28 to 30 in. in diameter, extends the entire length of the boiler and is connected with it by three openings. Through these the non-vaporized water returns to the boiler, and the steam generated in the latter gets into the steam-collector through the same openings. These connections can be seen in the illustrations. The under part of the collector, just above the firebox, is strengthened by a plate of soft steel, making it 1 in. thick. The holes for receiving the water-tubes are cut in this plate on a zig-zag line. The tubes are expanded into the bottom-pipe and the collector, so as to make them water-tight; their projecting ends are then conically enlarged, or bell-mouthed. From three to five holes are cut in the upper surface of the collector, and several in the bottom-pipes for fitting in the tubes and cleaning them. A steel casing encloses the banks of tubes and the space between it and the outer row is filled with a composition of asbestos scraps and other non-conducting material. Fire-bricks fill the space under the firebox door.

The advantage claimed for the Brotan boiler is that since the water-level is no longer in the longitudinal boiler, but about in the middle of the steam-collector, the former can be completely filled with fire-tubes. Hence the Brotan boiler is usually made considerably smaller than that of the ordinary locomotive, and even then it has about 10 per cent. more fire-tubes than the latter. The upright position of the water-tubes ensures a most active water circulation. As the tubes are very thin, and as the heating surface of the firebox is about 50 per cent. greater than that of the common type, steam is generated much more easily and carries the water very rapidly up into the collector. A test made of the first Brotan locomotive put in service in Austria and an ordinary locomotive gave striking proof of the steam-producing capacity of the former. The two boilers were filled with cold water and fired up simultaneously with brown coal, or lignite. After 2 hrs. 34 min. the Brotan boiler had developed a pressure of 171 lbs. per sq. in., having consumed only 624 lbs. of fuel, while the competing machine showed only 142 lbs. pressure after 3 hrs. 24 min., with a fuel consumption of 851 lbs.



Brotan Boiler, Adapted to American Locomotive, Showing Arrangement of Tubes.

The quick and easy repairing of the new firebox is also a great consideration. A tube can be removed and replaced within a few hours. Each one can be cut out with a chisel from the inside of the firebox, and a new one fitted in without disturbing the adjacent row. The holders of the Brotan patent claim that, where proper tubes are kept in stock, the entire system can be taken out and renewed within 14 days, while European shops generally take about four months to renew completely a firebox of the ordinary type. The technical bureau of the Prussian Railroad Ministry has said that the saving in repairs and cleaning is regarded by the Prussian authorities as the chief merit of the new boiler.

The boiler is also claimed to be much safer than that of the ordinary locomotive. The danger from explosions in the firebox is reduced to the danger from the bursting of a tube. There are no rivets or staybolts to "lose their heads"; and the high pressure to which the water-tubes have been tested warrants the engineman's feeling of security.

Not only is the cost of maintenance of the Brotan boiler claimed to be much less, but the original cost is also said to be lower. In European shops, where, as already mentioned, thick copper is used for firebox sheets and the staybolts are also made of that metal, 20 per cent. in the cost of construction is saved; in American shops the saving would be somewhat less.

The foregoing description applies to the usual method of construction. It may be worth while for American railroad managers and locomotive builders to know that a different type of boiler has been introduced so that an existing locomotive can be equipped with the new firebox. Any locomotive with a boiler 4½ ft. or more in diameter can be thus converted, and a number of these are already in use in Europe, or in process of transformation. In this form the steam-collector is connected with the longitudinal boiler at the boiler-head. To get sufficient space in the front tube-plate for the connection, the last ring of the boiler-barrel, if necessary, is en-

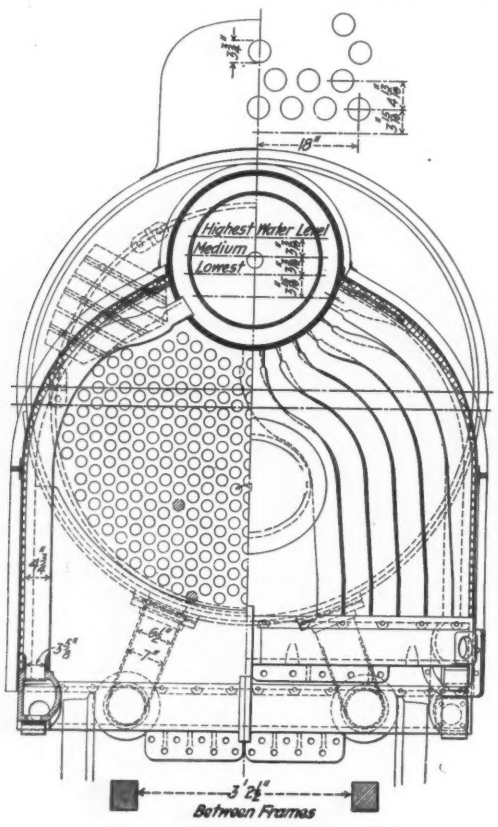


Fig. 1.

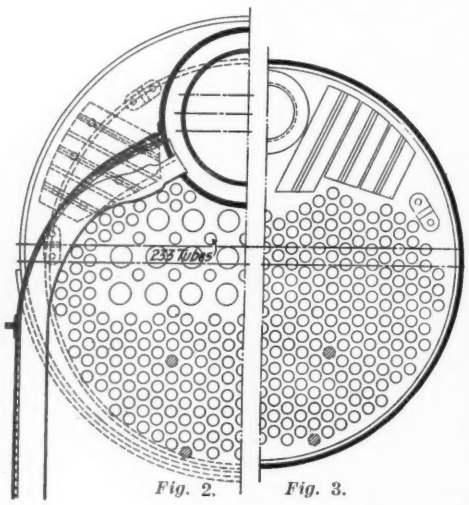


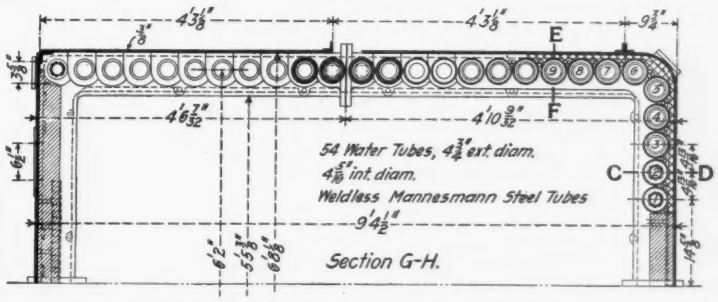
Fig. 2. Fig. 3.

Cross Sections of Firebox; Brotan Boiler.

Fig. 1, without superheater; Fig. 2, with superheater; Fig. 3, smokebox flue sheet.

Longitudinal Section of Brotan Boiler Adapted to American Locomotive.

larged conically at the top, as shown in the cross section taken at the boiler-head. The diagram shows such a locomotive. It was designed for one of the best-known American railroads, but, owing to causes already explained, has not yet been built. A reference to the diagram shows that such a locomotive, from the boiler-head forward, presents no outward difference whatever from the present type. Everything in the machine, indeed, will remain unchanged except the firebox; it is important to note that any ordinary firebox that needs considerable repairs can easily be replaced by the Brotan invention. Such a transformed boiler has a much greater



Section of Firebox on Line G-H.

heating surface, especially in the firebox, and is claimed to be more effective than present boilers.

The following table gives a summary of the principal dimensions of the Brotan boiler both with and without a superheater, as compared with those of an ordinary boiler:

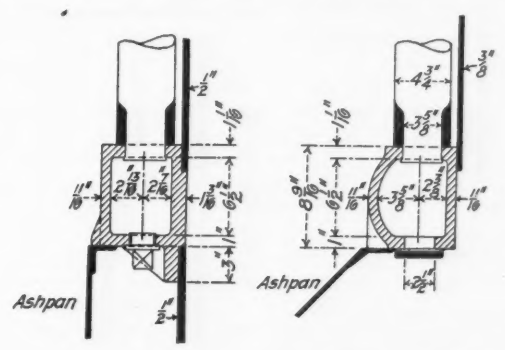
	Brotan boiler—With superheater.	Brotan boiler—Without superheater.	Ordinary boiler.
Working pressure	200 lbs.	200 lbs.	200 lbs.
No. of fire tubes, 2-in., O. D.	233	335	244
" fire tubes, 5-in., O. D.	22	..	22
" water tubes	54	54	..
Grate area	50.8 sq. ft.	50.8 sq. ft.	50.2 sq. ft.
Heating surface, firebox	215 "	215 "	180 "
" " of 2-in. tubes	1,785 "	2,577 "	1,820 "
" " of 5-in. tubes	424 "	.... "	413 "
" " total	2,424 "	2,782 "	2,413 "
Steam space at medium water level	80 cu. ft.	80 cu. ft.	80 cu. ft.
Water space at medium water level	330 "	320 "	330 "
Total capacity of boiler	410 "	400 "	410 "
Weight of empty boiler	42,250 lbs.	42,000 lbs.	42,550 lbs.
Do. boiler filled to med. water level	62,850 "	62,000 "	62,500 "

The following table gives the complete results of the trial competitions instituted by the Austrian railroad authorities:

WORK DONE AND FUEL CONSUMED.

No. of locomotive.	Work: Red. locomotive-miles.	Work: Effect. miles.	Work: 1,000-ton miles.	Load, tons per 1 eff. mile.	Standard coal: Total consumpt'n in lbs.	Standard coal: Per Loco. mile: Consumption, lbs.	Standard coal: Per Loco. mile: Saving, %	Standard coal: Per 1,000 ton-miles: Consumption, lbs.	Standard coal: Per 1,000 ton-miles: Saving, %	Boiler.
September.										
4752	1,611	1,136	131	115	82,430	51.1	....	629	....	Standard Type Boiler.
4756	1,657	1,091	140	128	78,980	47.6	....	564	....	Standard Type Boiler.
Total.....	3,268	2,227	271	...	161,410	....	....	...	....	Standard Type Boiler.
Ave.....	1,634	1,113	135	122	80,705	49.3	....	595	....	Standard Type Boiler.
4754	1,737	1,264	137	108	62,222	35.8	27.0	454	23.6	Brotan
October.										
4743	1,316	926	105	114	74,778	56.8	....	712	....	Standard Type Boiler.
4752	1,290	914	103	113	67,602	52.4	....	656	....	Standard Type Boiler.
4753	1,389	932	109	117	76,830	55.3	....	705	....	Standard Type Boiler.
4756	1,856	1,257	140	111	101,028	54.4	....	722	....	Standard Type Boiler.
Total.....	5,851	4,029	457	...	320,238	....	....	...	....	Standard Type Boiler.
Ave.....	2,925	1,007	115	114	80,059	54.7	....	699	....	Standard Type Boiler.
4754	1,582	1,126	122	108	68,687	43.4	20.7	563	19.5	Brotan

The Brotan patent is held by the Deutsch-Oesterreichische-Mannesmann-Röhren-Werke of Düsseldorf, Germany. It supplies the designs for the firebox and sells the rights to use the patent. The machines themselves have been built by various locomotive shops on the Continent. Owing to the high duty on steel tubing in the



Expansion of Tubes Into Bottom Pipe and Collector.

Dingley tariff law it would not perhaps be profitable for prospective American builders of the new boiler to import their tubes from Germany.

Consumption of Poles in 1906.

The following information is taken from Circular 137, United States Department of Agriculture, Forest Service:

The information in this circular concerning the consumption of poles during 1906 is based upon the number of poles purchased rather than the actual number produced during the year. It seems safe to assume, however, that the two were practically identical. Inquiries were sent out to more than 6,000 companies operating telegraph and telephone lines, electric light and power systems, trolley and street railway lines, and to railroad companies which operate their own telegraph or telephone lines. Practically all replied. The number of poles purchased during the year, as shown by these statistics, was 3,574,666, valued at $9,471,171 at the point of purchase. These figures do not include poles less than 20 ft. long. Shorter poles are used for local lines and for temporary work, but they constitute only a small percentage of the total.

Table 1 shows, by kinds of woods, the quantity and value of round and sawed poles purchased in 1906. In both classes cedar ranks first and chestnut second. These two together furnish nearly nine-tenths of all the poles used, cedar supplying about three-fifths and chestnut over one-fourth.

The telegraph and telephone companies purchased about two-thirds of the total number reported and the street railway, light and power companies about one-fourth. The remainder is credited to railroad companies which own and operate their own telegraph or telephone lines.

TABLE 1.—*Number and Value of Round and Sawed Poles Purchased in* 1906.

Kind.	Total. Quantity. number.	Total. Value at point of purchase.	Total. Average value per pole.	Round poles. Quantity, number.	Round poles. Value at point of purchase.	Round poles. Average value per pole.	Sawed poles. Quantity, number.	Sawed poles. Value at point of purchase.	Sawed poles. Average value per pole.
Cedar	2,174,279	$5,579,891	$2.57	2,169,869	$5,571,312	$2.57	4,410	$8,579	$1.95
Chestnut	988,084	2,625,568	2.66	987,303	2,619,314	2.65	781	6,254	8.00
Pine	177,809	686,803	3.86	162,601	590,736	3.63	15,208	96,067	6.32
Cypress	111,657	256,950	2.30	111,292	255,867	2.30	365	1,083	2.97
Juniper	57,064	163,437	2.86	57,064	163,437	2.86	...	.....	.....
Redwood	24,760	87,189	3.56	480	3,253	6.78	24,280	83,936	3.46
Oak	9,924	13,951	1.41	8,624	10,831	1.26	1,300	3,120	2.40
Fir	9,601	21,637	2.25	8,741	19,915	2.28	860	1,722	2.00
All other	21,488	35,485	1.68	20,901	35,025	1.68	587	720	1.23
Total	3,574.666	$9,471,171	$2.65	3,526,875	$9,269,690	$2.63	47,791	$201,481	$4.22

TABLE 2.—*Poles Purchased by Various Classes of Consumers in* 1906.

Kind.	Total. Quantity, number.	Total. Value at point of purchase.	Total. Average value per pole.	Telephone and telegraph companies. Quantity, number.	Telephone and telegraph companies. Value at point of purchase.	Telephone and telegraph companies. Average value per pole.	Steam railroad companies. Quantity, number.	Steam railroad companies. Value at point of purchase.	Steam railroad companies. Average value per pole.	Street railroads, electric light and power companies. Quantity, number.	Street railroads, electric light and power companies. Value at point of purchase.	Street railroads, electric light and power companies. Average value per pole.
Cedar	2,174,279	$5,579,891	$2.57	1,532,906	$3,079,852	$2.01	144,359	$371,246	$2.57	497,014	$2,128,793	$4.28
Chestnut	988,084	2,625,568	2.66	661,898	1,510,484	2.28	63,151	139,579	2.21	263,035	975,505	3.71
Cypress	111,657	256,950	2.30	21,395	36,559	1.71	11,976	20,271	1.69	78,286	200,120	2.56
Juniper	57,064	163,437	2.86	38,331	91,854	2.40	465	638	1.37	18,268	70,945	3.88
Pine	177,809	686,803	3.86	121,609	478,427	3.93	16,826	22,866	1.36	39,374	185,510	4.71
Oak	9,924	13,951	1.41	2,980	1,500	0.50	2,736	2,549	0.92	4,208	9,902	2.35
Fir	9,601	21,637	2.25	9	94	10.44	1,284	2,533	1.97	8,308	19,010	2.29
Redwood	24,760	87,189	3.56	7,140	24,390	3.42	9,871	21,920	2.22	7,749	40,879	5.28
All other	21,488	35,745	1.68	9,454	11,789	1.25	3,600	4,225	1.17	8,434	19,731	2.34
Total	3,574,666	$9,471,171	$2.65	2,395,722	$5,234,949	$2.19	254,268	$585,827	$2.30	924,676	$3,650,395	$3.95

SUPPLY.

The regions of supply of the two principal pole timbers—cedar and chestnut—are fairly well defined, and are, unfortunately, extremely limited. The present source of supply of cedar poles in the United States is confined almost entirely to the Lake states. The total purchase of cedar poles reported for the United States in 1906 was 2,174,279. The production of the Northwestern Cedarman's Association, which operates in the Lake States, as shown by the association statistics, was more than 1,700,000. The greater part of the production outside the Lake states can be credited to two sources—Maine and the adjoining states, including the Adirondacks in New York and the Idaho cedar territory. From these districts cedar poles are shipped to practically every state in the Union.

The regions from which the supply of chestnut poles is drawn are even narrower. A small territory—embracing parts of Pennsylvania, Maryland, Virginia and West Virginia—furnishes nearly all of these poles. Cypress poles necessarily come from the South, probably the greater part from the Gulf states; juniper, from Virginia, the Carolinas and other South Atlantic states. Redwood comes wholly from California.

With the regions of supply so restricted, transportation becomes an important factor. The cost of the pole is sometimes doubled by freight charges. This difficulty is obviated, in a measure, by the use of local woods, cypress and pine in the Southern states, for instance, and chestnut and juniper in the Atlantic states. On the Pacific coast cedar is supplemented to a considerable extent by pine and redwood. Both such local supplies are insufficient, and cedar and pine are found everywhere.

There are no data available which show even approximately the quantity of cedar still standing in this country or Canada to meet the enormous demand of 2,000,000 poles each year. It is certain, however, that when the present supply is exhausted it will be gone forever, since the cedar, though it reproduces fairly well, grows so slowly that other kinds of trees, chestnut for instance, will be more profitable to produce by systematic management.

SUITABILITY OF VARIOUS WOODS.

There are several qualities which timber must possess to adapt it to use for poles. The most important of these are: durability in contact with the soil, minimum weight, straightness coupled with relatively small size, and little taper. The wood must be soft, so that the spikes of a climber may enter readily, and at the same time it must have strength to support considerable weight. These qualities are admirably combined in cedar and in juniper, which commercially is a cedar. No other woods possess so many.

Chestnut and cypress are both durable; chestnut is not so straight as cedar and is liable to be knotty. The wood, though soft, is not as soft as cedar. It has greater strength, but this advantage is more than counterbalanced by its greater weight, which prohibits long shipments. Cypress frequently is too large for use as a pole and has greater value for lumber. Even when its general diameter is small enough the butt will often be so big that it adds too much weight. Pine, besides being heavier than cedar, is so much less durable that it cannot compete as pole wood without preservative treatment. Redwood possesses durability, lightness and softness, but its size necessitates sawing, which adds to the cost.

PRESERVATIVE TREATMENT.

One of the results of the increased cost of poles and the difficulty of obtaining a sufficient quantity of satisfactory stock has been an effort to increase the period of service of poles by preservatives, generally by applying a liquid to the whole of the pole or, more generally, to the butt, which is most liable to decay. Poles which have not been treated with preservatives may be expected to give from ten to fifteen years of service, roughly speaking.

Creosote is probably more extensively used than any other preservative, though ordinary paint is a common agent. For the butt tar is often employed, and charring by fire is found useful. The American Telephone & Telegraph Company is carrying on extensive experiments in co-operation with the Forest Service to determine the best methods and materials. Several experimental lines of variously treated poles have been erected and careful records of the behavior of each pole is being kept. By the comparatively new open-tank treatment the preservative is forced into the wood of the butt by a much simpler and more inexpensive method than was formerly used.

Successful preservatives make possible the use for poles of a great number of otherwise unsuitable timbers, many of them among the cheaper and more abundant woods.

Cab Signals.

The following discussion of the subject of signaling to and from the cabs of moving locomotives by means of electrical or mechanical contacts between the engine and roadway or roadside fixtures, is taken from the introduction to a paper by Mr. J. Pigg, recently read before the Institution of Electrical Engineers, London, describing the apparatus of Mr. V. L. Raven, in use on the North Eastern Railway. Mr. Raven's apparatus will be described in a future issue.

Of late years the subject of the signaling of railroads has re-

ceived a good deal of attention, and the difficulties under which drivers labor under exceptional conditions of weather have been officially recognized by references and recommendations from the inspecting officers of the Board of Trade. A number of systems have been devised and put forward during the last 10 or 12 years for supplementing the ordinary outdoor mechanical signals but, practically, no progress has been made in their application. Whatever the merits of the various proposals, not one has made any headway towards adoption, and railroads still continue to use the system of visual signaling—during clear weather—supplemented by the audible, explosive signal during fogs. This delay cannot, however, be laid to the charge of the railroad companies, who have on many occasions furnished opportunities for the trial of apparatus, but whose officers have, necessarily, to gage carefully the merits of proposals from every standpoint.

The problem to be faced is not a simple one.

At high speed the time allowable for the collection of a signal, by any reasonable design or apparatus, is very short, and the apparatus must be exceedingly prompt in operation. Where mechanical impact is relied upon for the operations, the stresses to which the parts brought into contact are subjected are tremendous, and in all forms of actuation involving mechanical contact between parts on the engine and parts on the line, the greatest possible care must be taken to minimize the blow experienced.

The financial difficulties are no less evident. Any system of supplementing the present signaling which does not take into account the cost factor will fail in a most important point. If the proposals hold out any prospect of relief in this respect so much the better. The engineer's object should be the keeping of the cost within the value of the service given, but certain things must be provided for railroad operations, regardless of cost, and signaling is one of these. It is much more difficult to prove that an accident has been averted by some means, than to point out, after the accident has taken place and the circumstances become known, how it might have been avoided by the means referred to.

If we carefully consider the operations involved in that mass of conventions known as the block system (in which term is included all apparatus used for signaling), we find that it implies implicit observance of the signals exhibited. We further find that while the signalmen are provided with reminders to a certain extent, and hedged about more or less completely with restrictions on their actions, the driver must rely upon his physical powers—sometimes under most difficult conditions—to enable him to observe and obey the signals by which he is to be guided * * * Man has many more interests than those appertaining to any one task he may undertake, and to carry out any work requires more or less exclusive concentration of the mind upon its details. Probably nothing is more difficult for the average man to accomplish than to concentrate his attention exclusively upon one subject for any length of time; his other interests will rise in his mind, and engage his attention unbidden, especially if his other duties are monotonous.

During the last two years the author has been associated, in a minor part, in experiments with apparatus which has been designed by Mr. Vincent Raven, the Chief Assistant Mechanical Engineer of the North Eastern Railway. The system is essentially an electrical one, which aims at reproducing in the cab of the locomotive, all the information that the driver now obtains from the present mechanical signals, but is not intended as a substitute for those signals.

The time when the driver most urgently requires supplementary indications is undoubtedly during fogs and snowstorms, but it by no means follows that it is only during such exceptional conditions of weather that supplementary indications are of value. Absence of mind is common. * * * No more strenuous duty can be imposed on a man than the driving of a 100-ton engine, with from 250 to 350 tons behind him, at a speed of 60 or 70 miles per hour, through a gray wall which never seems to end, where sight is useless, and the driver must endeavor to keep track of his position by the "feel" of the road and by the explosive signal which means for him the danger signal—the only practicable signal given to him.

Many suggestions for providing supplementary indications have been made during the last twelve or fourteen years, most of which have had as their object the giving of the indications directly on the engine, in the cab where they are most easily observed. Others, however, have aimed at producing a signal, ordinarily an audible signal, on the line.

The latter are merely variations of the present supplementary explosive signal, with the added disadvantage that they are not so readily heard. Much of the efficiency of the explosive signal is due to transmission through the body of the engine. The difficulty of conveying sounds from the line to the cab of an engine, running at a high speed, under ordinary circumstances is so great as to render such systems totally useless. Cab signaling is undoubtedly the only method worth consideration.

Purely audible signals leave no record; and purely visual signals need more attention than the driver can give. With the first he may forget which indication he obtained after it has ceased, either automatically or by his own action; with the second he may forget to observe it. From these considerations alone, it seems imperative that both classes of signals should be employed, the audible signal being of the nature of an alarm, or "call attention" signal, and the visual signals giving the "condition of line" signals, and route indications.

Choice of Design of Apparatus.—The design of the apparatus divides naturally into two parts—that of the indicating apparatus, and that by which the indications are to be produced. The indicating apparatus will be subject to violent vibration whatever arrangements are made, and must be capable of withstanding it. The means by which the indications are produced, if a contact system is used, will necessarily be subject to severe shocks, and must be strong. Purely mechanical apparatus for producing the indications, depending as it does upon impact, involving movement of some part against a resistance, has small chance of adoption on account of liability to failure under the stresses sustained, and the difficulty of operating such devices at the distances rendered necessary by the high speeds of trains. Where off signals are to be given, the cumulative effects of the multiplied blows would render such apparatus liable to constant failure. Moreover, mechanical systems, at their best, can never hope to reproduce in the cab, under the driver's immediate notice, all the information he obtains from the line signal.

The use of electricity offers much greater advantages, and enables the effects to be produced at any required distance from the operator without effort. The combinations that may be made with a given apparatus are more numerous, and the methods in which electricity can be utilized preclude the necessity for the violent shocks which are almost inseparable from purely mechanical operation. Nevertheless mechanical means may, if designed with a knowledge of the conditions to be met, be made to form a valuable auxiliary to electrical systems.

The collection of signals on the engine is a matter of the highest importance in any system of cab signaling. In purely mechanical systems, as has already been stated, this is done by contact of apparatus carried on the engine and apparatus fixed on the line which partakes more or less of an impact or blow. This blow may be minimized to some extent by the adoption of yielding devices on the engine or track, or by applying the contact more or less gradually by sloping devices, but the effects are but slightly reduced.

Electrical systems have generally to provide some form of mechanical contact between the circuits on the engine and those on the track, but as they do not necessarily involve the movement of the apparatus, their design need not follow the same lines. If efficient contact is established, that is sufficient. Metallic contact is necessary, and it has been thought that under the conditions of use snow and ice, or dirt, might form an objection by causing failure to make efficient contact. In any system whatever the design is the most important point. If the apparatus brought into contact is not such as will tend to clean, but rather to press and consolidate whatever the bar may be covered with, failure is sure to result.

Considerations like these have given rise to suggestions for contactless systems of collecting indications, of which Mr. W. S. Boult's system is perhaps the best known. These systems depend upon magnetic influence for the operation of the signaling apparatus on the engine, and are therefore independent of such conditions as have to be provided for in contact systems.

Requirements to be Satisfied by Supplementary Apparatus.—The distant signal is the one of greatest importance, since at that signal the driver gains information by which he is guided in his immediate subsequent actions. At that point he is informed of his position relatively to the stopping place of that signaling point, and he there obtains the "condition of line" and route indications if the line has been prepared for his further passage. What is required, therefore, in any supplementary apparatus is that it shall advise the driver, when he is passing a position corresponding to that fixed upon as the distant signaling point, of the condition of the stop signals in advance. If this is done, the driver is informed on all the points which it is necessary for him to know. The following points should be provided for:

1. The first useful operation is to inform the driver, by way of warning, of his position relatively to the signaling point he is approaching, at such a distance as will enable him to carry out any steps that may be necessary.

2. To advise him immediately afterwards of the conditions of the stop signals he is approaching.

3. If the off signal is obtained it should be accompanied by a route indication, which will enable him to judge whether the right road has been prepared at a diverging junction. It should be possible to reverse this indication at some point or points before the train passes the home signal, in case of emergency, just as it is possible to reverse an indication with the mechanical signals by throwing them to danger before they have been passed.

4. If the on signal is obtained, the indications on the engine should be maintained until the off signal is received. It should be possible to receive the off signal at some point or points between

the distant signaling point and the home signal to prevent unnecessary delay. It should be possible for the apparatus to indicate to the driver at some point or points how far he has traveled between the distant signaling point and the stop signal when the indication continues at on. It should be possible for the driver to obtain the off indication when standing at the home signal. It should also be possible to give a signal to a train standing at the home signal which would be of a cautionary character and distinguishable from the ordinary authority to proceed.

As corollaries, the following conditions should also be provided for:

(*a*) The warning signal should be given by the natural operations of the apparatus, and should require no action on the part of the driver or signalman to bring it into operation.

(*b*) The "condition of line" and the route signals should be under the sole control of the signalman, should be subject to the control imposed by the interlocking, and must be such that failure shall not be liable to give a dangerous false indication.

(*c*) The signalman shall be provided with indicators which will show him that the apparatus on the line, for giving the signals on the engine is in order, and that the apparatus prepared is in accordance with the positions of the signal levers.

(*d*) The apparatus on the engine should be of a reliable character, easily seen and heard, and such that the indications shall, as far as possible, correspond with the apparatus it is intended to supplement. It should be self-testing and be continually in use, so that failure may be instantly indicated, and it should be so arranged that attention can be readily given and defective apparatus easily removed and replaced.

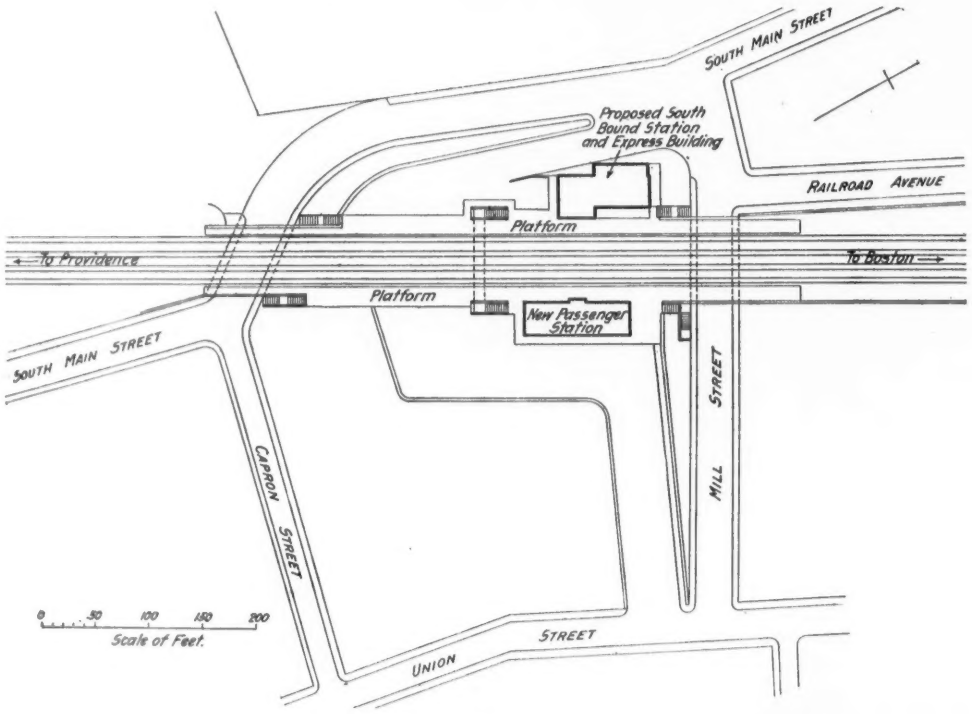
(*e*) The apparatus should be capable of easy adaptation to single or double line working.

Conservative Socialism in Belgium.

Belgium has a new Railroad Minister, by name Helleputte, who as deputy belonged to that section of the clerical majority of the Parliament known as Christian Socialists, especially devoted to the interests of the working man. But like many others who, radical as critics, become conservative when in authority, he finds that there is a limit to what the state can pay the working man; and when his fellow Christian Socialist, the Abbé Daens, moved that the minimum daily pay of an employee in the state railroad, postoffice and telegraph service should not be less than 3 francs (58 cents), he objected, affirming that the working expenses of the railroads had already increased seriously. The mover of the resolution said that at one station laborers were offered only 47 cents a day; and another deputy affirmed that there were employees receiving only 58 cents a day after 23 years service.

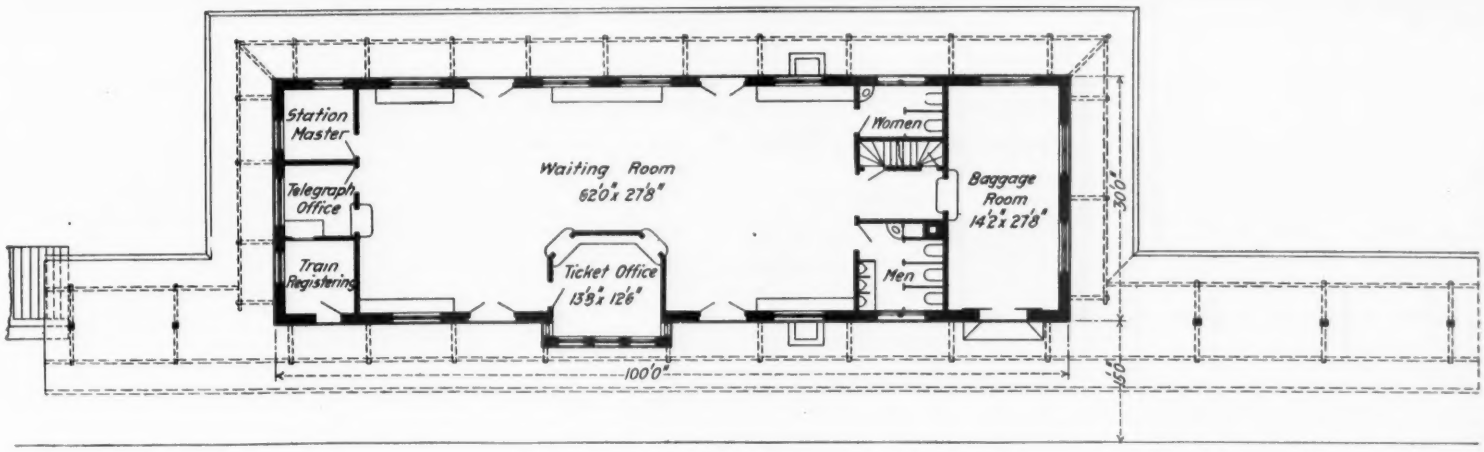
New Passenger Stations at Attleboro.

The New York, New Haven & Hartford has built new passenger stations at Attleboro, Mass., which is on the main line of the Providence division, 12 miles northeast of Providence, R. I. Elimination of grade crossings made new stations necessary and the northbound station, shown in the photograph, was built last year. The stations are between Mill and South Main streets, which the railroad crosses on granite arch bridges. The two stations will be connected by a concrete passenger tunnel under the tracks. At this point the road is on an earth fill so deep that concrete foundations for the stations were necessary, and in the southbound station advantage is taken of this situation to make a lower story, which is to be used for express. An elevator is to be installed to handle loaded trucks of express matter between the delivery floor and the track level. Temporary wooden platforms were laid, as it was not thought best to build concrete platforms until the earth had entirely settled. The lower walls of the southbound station are of granite masonry, harmonizing with the stone arch bridges and the retaining walls. The upper walls of this station and of the northbound station are of red brick with white joints and trimmings of granite and concrete. Both stations and sheds are roofed with red Spanish tile. The interior of the waiting rooms, toilet rooms and ticket offices are plastered, and finished in chestnut, stained dark brown. The other rooms are sheathed with varnished North Carolina yellow pine. An unusual feature

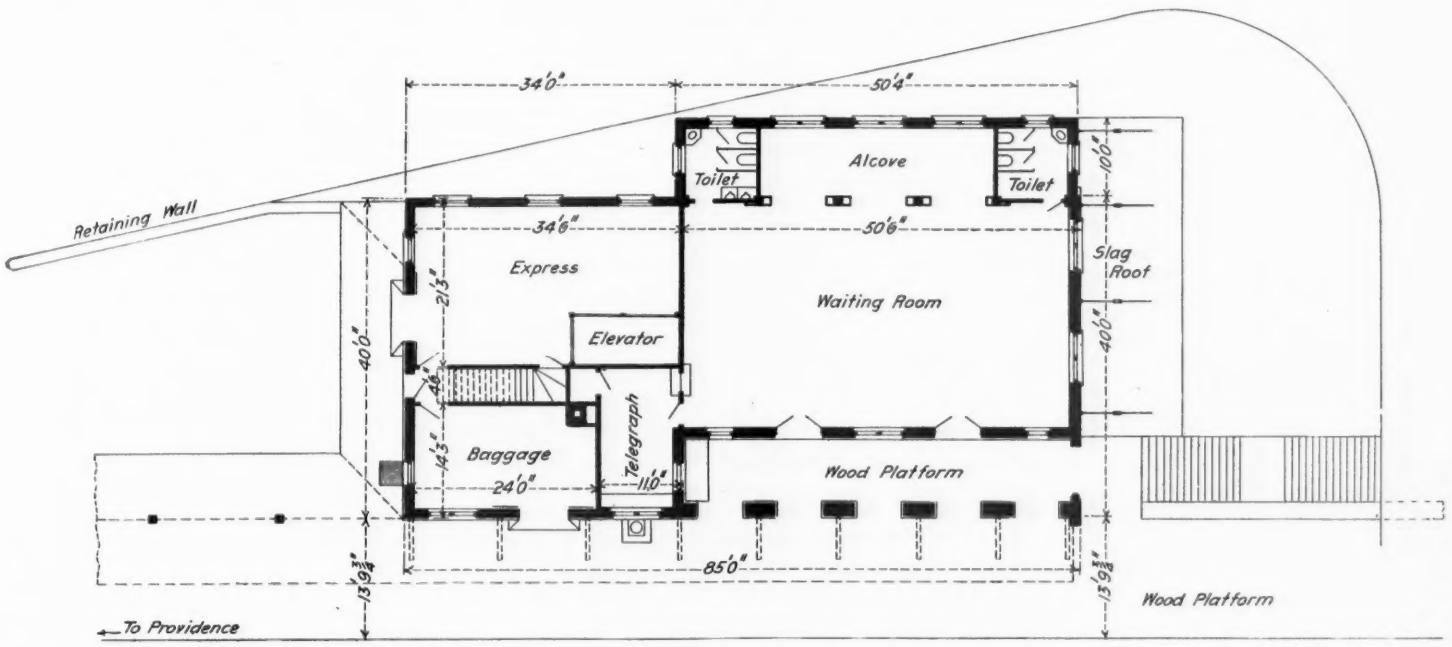


Stations, Express Building and Passenger Subway at Attleboro.

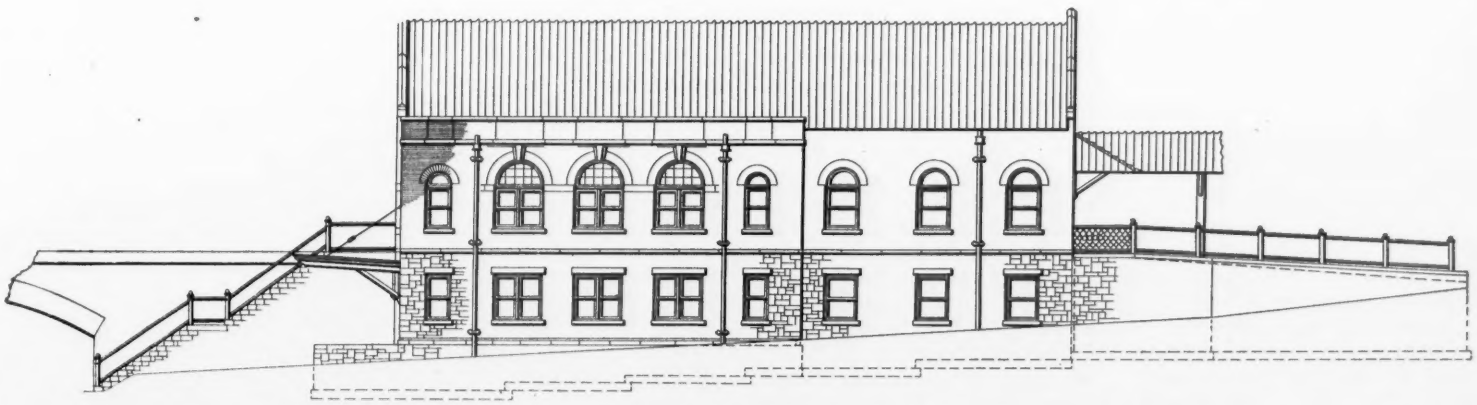
North Bound Station at Attleboro, Mass.; New York, New Haven & Hartford.



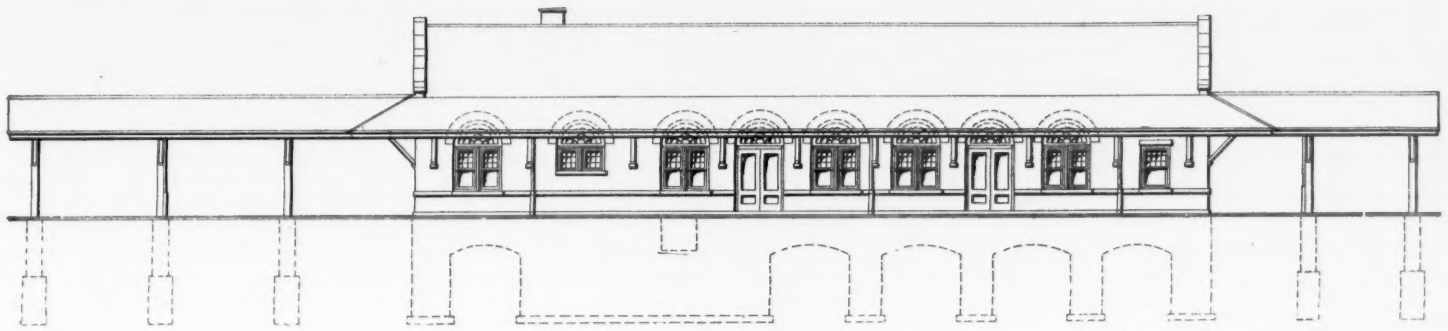
Plan of North Bound Station at Attleboro.



Plan of Main Floor; South Bound Station at Attleboro.



Street Elevation of South Bound Attleboro Station; New York, New Haven & Hartford.



Front Elevation of South Bound Station.

in the waiting room of the southbound station is the alcove, shown in the plan. The northbound station is now heated by a direct hot water system, but it is intended ultimately to heat both buildings by the direct steam system planned for the southbound station.

Picked Up on the Road.

BY GULF.

In these days when railroad managers are vying with each other in fast schedules on paper, and the dear public is left guessing as to the time of arrival and departure of trains, it would be a gracious act on the part of superintendents and general ticket agents to issue instructions to sellers, gatemen and ushers to give such full and complete information to travelers, as to mitigate, as far as possible, the irritation felt against their superiors because of the aforesaid paper schedules, and not withhold matters the knowledge of which would serve to allay the hostile feeling that unfortunately exists. To take a concrete case from experience; I was going from X to Z on the A. B. C. through line. There were two trains scheduled to run 15 minutes apart, and I, being somewhat experienced, and knowing that the A. B. C. trains were likely to keep in the fashion and run late, went to the ticket office at X at my convenience and asked, "How late is No. 17?" the first of the two trains. I was told that it was one hour behind. I bought my ticket and went away. Coming back in an hour or more and asking for a Pullman ticket I was informed that the parlor car had gone on No. 13 which had left only 30 minutes late. I really am afraid I said things to that agent for not telling me that 13 would lead 17, when he knew that it would when he sold me the ticket and answered my inquiries. But then, what's the use? No amount of instructions will put common sense into indifferent employees. And then, what could be expected on a line, in one of whose principal depots, I was once unable to find or procure or get access to a time-table?

I sometimes think, oh well! we are all agreed that centralization and consolidation is the order of the day, and also that it is demoralizing to the personnel. Those of us who travel, and have to do with the ticket agents and conductors and baggagemen, sigh for the time when the ear-marks of the superintendent were apparent in the land; when there was some sort of *esprit de corps* due to contact with superiors who could issue an order, and not have it referred up and up until it finally disappeared in the hazy proceedings of the Board. If you want to do business with a man, you go and see him. If you want to have your cavalry charge a success, you don't send a telegram to your men, but you order boots and saddles sounded and head the line yourself. If your ship is in a storm and the seas are boarding her, you are upon the bridge and not asleep in the cabin. But if you are a railroad magnate you expect to reach success through a series of letters and telegrams and reports. Everyone of you appreciates the value of personal contact, but how many of you ever take a trip over your own road in a day coach? How many of your men know you and how many do you know? How often, too, do you ask the conductor of your train to come back into your car for a talk? How much do you know of the ideas held by your men? How often have you consulted them personally before an order was issued? When did you ever sit in a day coach or even in a Pullman and talk to a passenger about your road? And finally, how much can you tell your masters in Wall street of all these things? A certain ruler knows their value. You give him a special train and pay the engineer and fireman and conductor and trainman for the service they give him, but when he reaches his destination, he shakes hands with the whole crew and asks after their babies—and they would vote for him and follow him and back up his policies to the utter damnation of you and your road and their own welfare! He doesn't send an *aide-de-camp* to express his good will, he goes himself. And really, you would be surprised to learn how little of his time it takes, and how little it would take of yours to follow suit. None at all, in comparison with the dividend it would pay.

I wonder how much of the popular hostility to railroad interests is due to the work of politicians and to inflammatory writings that are published to sell, and how much to unfortunate personal experiences! How many commuters have got it in for the road they use every day because of what they read in their morning paper, and how many because of the failure to keep the promise of the guessing sheets, formerly known as time-tables? How many casuals believe in government Control with a big C, because of the insolence or indifference of a ticket agent, forgetful of the fact that for supremacy in indifference, insolence, and all other aggravating qualities one must go to a government employee? How many women lend their influence to the movement to down the railroads because their trunks came out of a baggage car rather too rapidly, and the corners were not as strong as the conditions demanded? How many regular travelers think "something ought to be done," because they don't make connections and are always late at destination, and yet, being regular travelers, realize that it's pretty difficult to draw up an exact specification of what that "something" should be? How many employees follow the teachings of the demagogue and the politician one grade removed, because the demagogue and the politician shake hands with them and call them by name and ask after the wife and babies, and the general manager doesn't? Every month there is a frantic appeal from some general ticket or freight agent to his men to be polite and to make the public think they are interested in their welfare. They realize that sweet oil is a better lubricant than vinegar, but I doubt if any of them have the time to come into any very close personal contact with their representatives, and so the work of betterment lags.

This placing of blame on the superintendent and general manager, to which I plead guilty, may, however, partake of the nature of the story of the office boy who, when asked who was the responsible party there, replied: "I don't know who's responsible, but I'm always to blame." Perhaps—you see I'm repentant now for all the things I've said—perhaps the responsibility lies higher up, while we, the public, blame the department heads. When locomotives are bought by men who don't know a mogul from an Atlantic, and superintendents of motive power and traffic officers are ignored, and Wall street is all sufficient unto itself, it is quite natural that some things should be as they are. When men get control of a road and do not realize that there are things to be learned beyond the pale of high finance, and pleasure, and the clipping of coupons, the men represented on the Board are apt to be those whose skill in brightening the executive lunch, in percentage calculations, in getting speed out of automobiles, is acknowledged; balanced, perhaps, by some silent men of substance who can clip a coupon with all the dexterity that Louis XVI. showed in the opening of an egg, and who have about as much value to the road as he had to the state. Then if there happens to be a busybody in the crowd, a man who takes interest enough to meddle, why, then—ye gods and little fishes!—we have a condition to make the economist weep and the stockholders gnash their teeth. Blame and responsibility then become separate and distinct, and we follow the motto of Donnybrook Fair and hit the visible head regardless of its degree of offensiveness. Possibly, quite possibly, we have swung through the whole circle only to locate the seat of public hostility to railroads, of the wariness in taking up railroad securities, of the indifference of employees, of the clerical positions occupied by departmental heads, of the indifference to contract agreements as shown in the issuance of the guessing-sheets, and of the general demoralization that sometimes seems to pervade the service, in the magnates of high finance who do not know that they do not know, and so have not the wisdom to direct what they want accomplished in operation and management and then leave it to the competent men in the service to bring about this result in their own way without let or hindrance or dictation as to details.

People who have traveled and noticed, frequently remark upon the rapidity with which the crowds of the New York Elevated and Subway trains are handled. Away back in 1878, when the Sixth Avenue or Gilbert Elevated Railroad was opened, the guards began urging the passengers to "step lively," and have kept it up ever since, with the result that they do step lively and station stops are materially shortened. Suppose, now, there were to be someone in authority all along the line of—well say the A. B. C. Railroad—or to accompany trains that are late—say all trains, to avoid controversy, and to be on hand at the baggage, express and mail cars to shout a "step lively" to the men at work and thus hasten the movement of the Saratogas and Innovations, thereby cutting down station stop delays! It would help matters somewhat, and serve to put the running time a little more on a par with the representations of the guessing-sheet. It's rather discouraging to the driver who has succeeded in scaling three or four minutes off a run of 40 miles, or made up some time, to lose five minutes of it through the station baggageman's desire to tell the train baggageman about his wife's sister's boy; or through the general indolent handling of baggage and express. He sympathizes with the foreman of a gang of chattering Italians, who, disgusted with their volubility, shouted: "There yez, jist sthop yer dagoing, an lift!"

The Bologna Chamber of Commerce recently sent a circular of inquiry to the chambers of commerce of all the other cities and towns of Italy, asking for opinions as to the present handling of traffic on the State Railroads. From one solitary place, Turin, came the answer that it is generally satisfactory. Many said that it is better than formerly; but a large number declared that it continued to be very bad. A summary of the answers is that most of the chambers of commerce find the railroad service unsatisfactory from causes due both to equipment and to the staff of employees. There is negligence in maintenance, delay in making repairs, and indifference in operation. The lower employees are deficient in sense of duty and honor. Complaints bring nothing better than promises. One chamber complains especially that nothing can be done without tips.

Ship Building During 1907.

The world's output of ships in 1907, according to *The Marine Review*, was 3,330 vessels with a tonnage of 3,220,399 tons. In 1906 the world's output was 2,941 ships of 3,323,250 tons.

In point of tonnage the American Ship Building Company, of Cleveland, Ohio, leads the ship builders of the world, having built 34 vessels of 191,602 tons. The next is the corporation of William Doxford & Sons, Sunderland, England, which built 22 vessels of 91,254 tons at one ship yard. The American Ship Building Company has seven yards, so that it is not altogether fair to put it at the head of the list, but it built a greater tonnage than any other company. The following table shows the first nine companies in output of tonnage during 1907:

	Vessels.	Tons.
American Ship Building Co.	34	191,602
William Doxford & Sons	22	91,254
Swan, Hunter & Wigham Richardson	19	75,818
Harland & Wolff	8	74,115
Russell & Company	14	71,705
Workman, Clark & Co.	24	63,245
The Great Lakes Works	10	58,051
The Bremer Vulcan Works	11	49,431
The Fairfield Company	6	48,027

Comparing the different countries of the world, the United Kingdom is not only far and away the leader, but built more ships of a greater tonnage than all the other countries of the world put together. Great Britain and Ireland produced 1,571 ships of 1,724,921 tons during the year; including the colonies, the total output of the British Empire was 1,764 vessels of 1,758,601 tons. As against this, the output of all other countries was 1,566 ships with a tonnage of 1,462,798. The United States comes second with 189 vessels of 488,340 tons. Germany is third with 513 vessels, whose aggregate tonnage however was only 315,548 tons. In this comparison between Germany and the United States is clearly shown the great size of the bulk freighters on the Great Lakes which constituted nearly all of the American output. The following table shows the world's output by nations during 1907:

	No.	1907. Board of Trade, tons.
Great Britain and Iseland	1,571	1,724,921*
The Colonies and dependencies	193	33,680
Total of British Empire	1,764	1,758,601
United States	189	488,340
Germany	513	315,584
France	51	113,345
Belgium	42	17,630
Holland	344	152,371
Denmark	39	24,488
Norway	75	51,523
Sweden	34	15,646
Spain	4	4,341
Italy	26	86,370
Austria-Hungary	48	41,960
Greece	1	150
Russia	13	20,700
Japan	157	126,068
China	30	4,282
Total output	3,330	3,221,399

*51,800 tons warship displacement.

A Comparison of Earnings and Operation of Nine Western Railroads.

The *Wall Street Journal* has made an elaborate analysis of the earnings and operating results for the year ended June 30, 1907, of the four big granger railroads, the four transcontinental lines in the United States north of the Southern Pacific, and the Canadian Pacific. Every one of the roads is an important grain carrier.

The comparisons are made in percentages, using the results on the Chicago North-Western as a standard, the results on that road being taken as 100 per cent. in each case. By this means the other roads can be compared not only with the North-Western but with each other.

The first table gives average mileage operated, gross earnings, operating expenses (not including taxes) and net earnings:

Mileage and Earnings.

Railroad.	Mileage worked.	Gross earnings.	Operating expenses.	Net earnings.
Chicago & North-Western	7,550.64	$68,878,931	$44,789,025	$24,089,906
Per cent	100	100	100	100
Chic., Mil. & St. Paul	7,049.46	60,548,554	39,400,410	21,148,144
Per cent.	93	87	88	88
Chic., Burl. & Quincy	8,863.40	82,473,250	58,904,987	23,568,263
Per cent.	117	119	131	98
Chic., Rock Island & Pacific	7,780.26	60,238,419	41,044,142	19,194,277
Per cent.	103	87	90	79
Canadian Pacific	9,153.90	72,217,527	46,914,218	25,303,308
Per cent.	121	105	105	105
Atch., Top. & Santa Fe	9,273.15	93,683,406	58,867,901	34,815,505
Per cent.	123	136	131	144
Great Northern	5,982.31	55,144,402	32,562,775	22,581,626
Per cent.	79	80	73	94
Northern Pacific	5,443.67	68,534,832	37,664,316	30,870,515
Per cent.	72	99	84	128
Union Pacific	5,644.55	76,040,726	40,574,889	35,465,857
Per cent.	74	110	91	147

This table shows that the Burlington, with 117 per cent. of the North-Western's mileage, has about the same ratio of gross earnings. Its operating expenses, however, are 131 per cent. of the other road's and its net earnings in consequence only 98 per cent. of the North-Western's. In the same way, the Rock Island, with 103 per cent. of the mileage, has only 87 per cent. of the North-Western's gross and only 79 per cent. of its net.

On the other hand, the Atchison, with mileage of 123 per cent. and expenses of 131 per cent., has 144 per cent. of the net. By far the best showing is that of the Union Pacific. With but 74 per cent. of the North-Western's mileage it earned 110 per cent. as much in gross, and by keeping operating charges down to 91 per cent. manages to show 147 per cent. for net. The Northern Pacific makes almost as good an exhibit. While the Chicago & North-Western spent 65 per cent. of its total earnings for operation, this road, with almost exactly the same amount of gross earnings, used only 55 per cent. of gross for this purpose.

The following table gives the ton miles, the freight density (tons one mile per mile of road), and the mileage of freight and mixed trains, which in one way expresses the amount of energy used in moving the freight:

Ton Mileage, Freight Density and Train Mileage.

Railroad.	Tons 1 mile revenue freight.	Tons 1 mile per mile road.	Miles of frt. & mixed trains.
Chicago & North-Western	5,428,771,597	719,042	20,591,011
Per cent.	100	100	100
Chic., Mil. & St. Paul	5,155,662,231	731,403	17,805,620
Per cent.	95	102	86
Chic., Burl. & Quincy	7,169,879,492	808,966	18,410,855
Per cent.	132	111	89
Chic., Rock Island & Pacific	4,281,228,365	550,286	16,084,714
Per cent.	79	76	78
Canadian Pacific	5,789,191,940	632,422	19,399,133
Per cent.	107	88	95
Atch., Topeka & Santa Fe	6,842,669,206	738,021	24,058,639
Per cent.	124	103	117
Great Northern	5,370,157,882	897,719	9,788,355
Per cent.	99	125	48
Northern Pacific	5,504,444,098	1,011,102	13,532,148
Per cent.	101	140	66
Union Pacific	5,704,061,535	1,010,641	14,086,856
Per cent.	105	141	68

The St. Paul, with 95 per cent. of the North-Western's ton mileage, handles it with 86 per cent. of the number of trains, while the Burlington makes a better showing with 132 per cent. of the tonnage and only 89 per cent. of the train mileage. The Rock Island has practically the same ratio as the standard taken. The Northern Pacific and the Union Pacific again make an economical showing in carrying a little more freight than the North-Western with two-thirds as much effort. But the Great Northern easily takes off the palm for economical handling of freight. With about the same amount of tonnage as the North-Western it used only 48 per cent. of the train mileage to move it.

In the next table the revenue trainload, the number of cars per freight train and the average load in each loaded car are shown:

Trainload and Carload.

Railroad.	Av. No. tons rev. frt. per train.	Pr cent.	Av. No. of cars per frt. train.	Pr cent.	Av. No. tons loaded frt. car.	Pr cent.
Chic. & Nor.-West'n.	262.65	100	25.5*	100	15.33	100
Chic., Mil. & St. P.	289.55	109	27.1	106	14.72	96
Chic., Bur. & Q.	389.45	147	30.24	119	17.56	115
Chic. R. I. & Pac.	266.17	101	23.07	90	15.27	100
Canadian Pacific	295.38	112	22.96	90	16.67	109
Atch. Top. & S. Fe.	284.42	108	28.61	112	15.46	101
Great Northern	548.68	208	35.54	139	20.44	133
Northern Pacific	406.77	154	28.98	114	17.78	116
Union Pacific	404.92	153	30.02	118	18.2	118

*1906.

The most striking feature of these figures is again the economical handling of freight by the Great Northern. Carrying on an average 20.44 tons per mile in each loaded freight car it makes a showing of 133 per cent. as compared with the Union Pacific's good record of 18.2 tons and 118 per cent. The Northern Pacific is close behind with nearly 18 tons.

The last table shows the average gross revenue received by each road per freight train mile and average ton mile rate:

Train-Mile and Ton-Mile Revenue.

Railroad.	Av. rev. per frt. train mile.	Per cent.	Av. rev. pr ton pr mile.	Per cent.
Chicago & North-Western	$2.40	100	$0.90	100
Chicago, Mil. & St. Paul	2.47	103	.85	94
Chicago, Burl. & Quincy	3.07	128	.79	88
Chicago, Rock Island & Pacific	2.53	105	.95	105
Canadian Pacific	2.29	95	.77	85
Atchison, Topeka & Santa Fe.	3.07	128	.95	105
Great Northern	4.27	178	.77	85
Northern Pacific	3.57	149	.87	97
Union Pacific	3.89	162	.96	108

The Great Northern again shows the lowest average rate of the American roads, .77 of 1 cent, which is as low as the Canadian Pacific's, while at the same time it earns the most per train mile. Only the Canadian Pacific earned less per train mile than the North-Western, although five of the other seven roads received a lower ton mile rate. The Union Pacific received the highest ton mile rate, .96, while the Rock Island and the Atchison got .95 of 1 cent

each, from which the latter realizes $3.07 per train mile compared with $2.53 for the Rock Island. The Atchison's ton mileage explains this, for it is almost 160 per cent. of that of the other road.

A Locomotive Sled.

The accompanying photographs show a new type of traction engine for hauling logs over snow and ice roads. The boiler is mounted on a heavy channel iron frame. These channels are reinforced and extend from the extreme front end to the rear of the machine, supporting the cab and the coal bin. The water tank is carried under the boiler on the same frame and has a capacity of about 10 barrels (315 gallons) of water, which is enough for a run of five miles. The frame rests on heavy traction wheels in the rear and on a sled in front. The boiler is 30 ft. long and 2 ft. 11 in. in diameter; the working pressure is 200 lbs. The boilers are jacketed with a 2-in. covering of moulded magnesia, outside of which is a heavy iron jacket. The flues are 1½ in. in diameter. There are four upright cylinders bolted in pairs, two on each side, to the frame and the boiler. They are 6½ in. in diameter, with 8-in. stroke, and are heavily jacketed with magnesia and planished iron. The valve gear is a reversing link motion.

That part of the weight of the engine which in an ordinary locomotive would be carried on the drivers, is in this machine carried on a transverse 5½-in. shaft. This shaft in turn rests on steel castings which act in the same way as the runners on a sled, although, as will be seen, they do not touch the ground. These runners carry on each end journals in which auxiliary transverse hammered iron shafts run. On each of these shafts there is a sprocket wheel carrying a tread or lag chain, which is 12 in. wide and about 14 ft. long. Inside of these sprockets are other sprockets carrying steel roller chains. The runners bear on these rollers, which in turn rest on the tread chains when the machine is in operation. Power is transmitted from the crankshaft to the longitudinal driving shafts by spur pinions. The rear ends of the driving shafts are geared to large beveled gears on the single transverse shaft first mentioned. From this shaft the power is transmitted to the rear sprocket by intermediate gears. All gears are cut from solid steel; they are pressed on the shafts under heavy hydraulic pressure. The runner castings, sprockets, tread chains and all parts subject to strains are made from a high grade of cast steel and built for severe work.

In their other fittings these engines in general follow standard locomotive practice. The cabs are fitted up like a locomotive cab, with quadrant, reversing lever and regular locomotive throttle. Each engine is fitted with a double sight feed lubricator and two injectors. Twenty feet of suction hose and 30 ft. of steam hose are also part of the equipment.

One of these engines weighs 15 tons without water and about 18 tons ready for the road. At 200 lbs. pressure it develops 100 h.p., and has a speed of from four to five miles an hour. While it can be used in rough country, it needs easy grades for satisfactory working. Water must be supplied every four or five miles. On well graded and icy roads it will handle from seven to 15 heavy logging sleds with 5,000 to 7,000 board feet of logs to the sled. Twenty-nine of these engines are now being used in Minnesota, Wisconsin, Michigan and Saskatchewan by 20 lumber companies. Some of these are making 50 miles a day and doing the work of from 12 to 18 four-horse teams. There are three men in an engine crew: the engineman, the fireman and the pilot, who steers the front sled by the wheel shown in the photograph. The engines are built by the Phoenix Manufacturing Co., of Eau Claire, Wis.

Traction Engine for Ice Roads Hauling String of Log Sleds.

Locomotive Sled for Hauling Logs on Ice Roads.

The Railroad from the Red Sea to the Soudan.*

The new railroad which the British have built from Atbara to the Red sea begins 200 miles north of Khartum in the heart of the Nubian desert, and runs to Port Soudan, 332 miles. It crosses one of the bleakest deserts on earth. There is no vegetation at all between Atbara and the Red Sea until within about nine miles of the coast, where there is a scanty growth of thorn bush and scrub, which feeds small flocks of camels and sheep. The only inhabitants of the desert are Nubian tribes, who go about from place to place, living in tents of matting, seeking pasture for their flocks and camping by the occasional wells.

This road was opened in 1906 and now has more freight than cars. All the trade of the Soudan will probably go over it, and, it is believed, much of the tourist travel as well. Already the Mohammedan pilgrims, from central Africa and the whole Upper Nile valley are taking this railroad on their way to and from Mecca; some of the tourists who go up the Nile are returning by the Red sea and ships are now sailing regularly from Port Soudan to Suez.

In the past all freight for the Soudan has been landed at Alexandria and carried by rail or boat up the Nile to Shellal, a distance almost as great as from New York to Chicago. There it has been taken by steamers to Wady Halfa and thence on trains to Khartum. On the way to Shellal the railroad freight had to be transferred from the broad-gage cars at Luxor to the narrow-gage from Luxor to Assouan. All of these transfers were costly, the freight rates were high and the time slow. Now ships go right through the Suez canal to Port Soudan, on the Red sea, and there land their goods for the Soudan. The freight is transferred almost direct to the cars, which by one continuous 500-mile haul land them in Khartum. In the past, wheat could be sent from Chicago to Liverpool at a lower rate than that which formerly prevailed between

*From a letter written by Frank G. Carpenter to the *Deseret News* (Salt Lake City).

Khartum and Wady Halfa. The cause for this was the high price of coal, all of which had to be brought up the Nile from Alexandria The coal is now coming in direct from the Red Sea.

Atbara, the station which forms the terminus of the Red Sea railroad, is in the heart of the Libyan desert. It is about 200 miles north of Khartum, at the junction of the Atbara river and the Nile. It is also at the junction of the Red Sea railroad with the great trunk line which may some time go from Cairo to the Cape. The northern section of the latter starts at Alexandria and runs northward through here to Khartum, where the Blue and White Niles come together and form the main stream.

The Atbara river, which can be plainly seen from this station, is the last branch that the Nile has between this point and the sea. The Atbara rises in the Abyssinian mountains and it carries down to the Nile every year millions of tons of the rich Abyssinian mud which makes so fertile the Lower Nile valley. During a part of the year this river has a volume which compares with that of the greatest rivers of the world and at other times much of it is as dry as a bone. From March until June for about 150 miles above Atbara you can walk across it in most places without wetting your feet and there is water only here and there in the depressions and pools. These contain hippopotami, crocodiles, turtles and fish.

The great floods begin in July and last till October. Then the waters are about 30 ft. deep and they roll down in a great river from a quarter to a half a mile wide. They are of a reddish color and are loaded with the volcanic dust of which the Abyssinian highlands are made. When the floods come they bring down masses of driftwood, on which are sometimes the dead bodies of elephants and buffaloes. The waters come with great force. The Atbara bridge, over which the railroad crosses the river, was built by an American bridge-building company, and was sent here in sections. It consists of six great steel spans of 200 ft. each, built on piers which extend 30 ft. down under the river to the bed rock.

Atbara, lying as it does at the junction of the two chief lines of the Soudan, is an important railroad center. The railroad shops, which lie here in the sands of the desert, cover two or three acres of the bleakest part of the earth. They are great sheds, with walls of galvanized iron and roofs of iron and plate glass. The machinists are a mixture of whites, blacks and yellows, representing a half dozen different nations and tribes. There are British overseers, Greek and Italian mechanics, Nubian blacksmiths, and many Nubian boys taking a manual training course in order that they may serve as locomotive engineers, under-machinists and trackmen.

The desert is a great wear and tear on the equipment. The sands ruin the car wheels. The desert is covered with grains as hard as flint. They blow over the rails, and as the cars move they grind out the steel as though they were emery powder. Deep grooves are cut out. As a result a wheel's life is short, and the tires have to be cut down every few months. Moreover, the sand gets in the bearings, and there is continuous wearing which necessitates almost constant repair.

Sandstorms are serious obstacles to traffic. At times they come with such violence that they cover the tracks; they darken the sun so that when you are in one you cannot see your hand before your face. They often spring up afar off, and you can watch them coming. At such times the sand gets in everything and grinds its way through all parts of the machinery.

Another thing to contend with is the extraordinary dryness of the air, which shrinks everything connected with the road. The rolling stock has to be tightened up again and again. One of the passenger cars will shrink as much as 18 in. in one wall alone, and extra boards have to be put in to fill up. This is so with all sorts of woodwork.

Another trouble is the white ant, which eats anything wooden. It chews up the insides of the cars and even attacks the furniture. Where there is any least moisture the ants go for the railroad ties, and they will also chew out the insides of the wood telegraph poles. They always work in the dark, leaving a thin shell of wood outside. The result is that a tie or pole may look sound, but all at once it crumbles to pieces. The road has to be inspected very carefully at regular intervals. Steel shells are now being used as ties. They do not make as smooth a road as the wooden ties, but the ants cannot eat them. Steel telegraph poles are also used.

American locomotives, according to the manager of the road, do not compare well with those from Great Britain. Some American engines were bought seven years ago, and are still in use, but most of them have been repaired and made over. American builders make locomotives, expecting to be run to their full capacity for four or five years and then thrown on the scrap heap. This is not advisable in the desert, where freight costs so much and the trouble of getting rolling stock is so great. What is wanted is machinery that will stand all sorts of trials, including the climate; rustproof and rotproof and heavily made all around. There is not only the dry air and the sand to contend with, but in the neighborhood of the Red sea, also the salt air and the alkali water. The latter ruins boilers, more so, in some respects, than the sand.

The lack of water is one of the chief difficulties. The railroad is over 300 miles long and the track is laid through the sand. For about one-third of the distance inland from the Red sea the country is mountainous, but the rest is flat. There are no streams, and artesian wells furnish the water supply. The water in them in many places is salt. One well had 3 per cent. salt in it, and another 1 per cent. salt. Of course such water is useless for locomotives.

There is also trouble in getting a good water supply at Port Soudan. One well was sunk to a depth of 800 ft. and struck a good flow of fresh water. It was hardly completed, however, before the salt water from the Red sea began to seep in. There are some stretches along the route where there is no water whatever. In such places water has to be carried. For this tanks of galvanized iron, each of which will hold about 1,500 gallons, are used.

This road is the short cut to the Soudan and Central Africa, and it is likely to have the most of the carrying trade of that region. The country is vast, and it is just now on the edge of its development. Goods will be brought over the Red sea road to Khartum and thence sent up the White and Blue Niles. There will be new roads going out from Khartum connecting the Nile with all parts of the country, and both the rivers and the road will be feeders of the Red sea line. A bridge is being built across the Blue Nile, which will carry the road directly into Khartum, and in the near future a bridge will probably be built across the White Nile, which will take the road to Omdurman.

The railroad terminus on the Red sea is known as Port Soudan. The original intention was to end the road at Suakim, but the British surveyors found a much better port a little farther north and located the terminus of the railroad there. This is Port Soudan. It lies about half way down the west coast of the Red sea and just opposite Jeddah, about 500 miles south of Suez. The harbor there is the mouth of a creek shaped like a leaf, with the point inland. The water is 200 ft. deep in places, and there is deep water close to the shore. Just outside is a coral reef, which protects the harbor. The British are now dredging the edge of the harbor, and they will have it so that the biggest ocean steamers can come right up to the quays. They are building a quay wall of granite blocks nearly a mile long, with electric traction cranes running on it. The railroad tracks will come out on the wall and the freight will be loaded and unloaded by the cranes into the ships and the cars. The harbor will be lighted by electricity and the best of coaling arrangements supplied. The government has already planned an enpenditure of $4,000,000. Most of the improvements are well under way. Six or seven lines of steamers now make regular callings there, and the prospect is that Port Soudan will be the chief port of the Red sea and the principal place of import and export for lower Nubia, and a large part of central Africa.

Foreign Railroad Notes.

The Austrian State Railroads are to renew the tracks of lines on which express trains run, where 70-lb. rails are the rule now, with 85 and 90-lb. rails.

The German Dining-Car Co. in its last fiscal year had cars on 25 different routes, 15 of which yielded a profit and the other 10 a loss; but the net result made a dividend of 10 per cent. possible. Since June smoking has been prohibited in these cars. The receipts for food have increased since; but there has been a material falling off in the money taken in for drinks.

The French Minister of Public Works recently announced to the Chamber of Deputies that he should soon lay before the Senate what he considered uncontrovertible evidence that the state should immediately acquire the Western Railroad system. The Chamber had already voted in favor of this; but the Senate has delayed action. It is doubtful if it can delay much longer.

There is talk of putting on a limited train between Paris and Munich. The latter city is on the route of the "Orient Express," which, however, adapts its time more to Vienna and the East than to the Bavarian city, and, moreover, is likely to be so crowded that Munich passengers haven't a fair chance. The proposed train would be a sort of through-by-daylight Empire State Express, leaving Paris at 8 a.m. and arriving in Munich at 10.25 p.m. (565 miles), and leaving Munich also at 8 a.m., and arriving in Paris at 9.15. On the route are such important places as Strassburg, Karlsruhe and Stuttgart. This will make a neat little 40 miles-an-hour run.

Russian Turkestan, since the opening of the Orenburg & Tashkend Railroad, may become for Russia what California has become for a large part of this country—and some other parts of the world—that is, its fruit garden. It produces very fine fruit, and

when it has more skilled fruit-growers, and co-operation among them, and cold storage, and refrigerator trains, and reasonable railroad speed, and low freight—for Turkestan, like California, is very far from its market—it may blossom like San Jose and Riverside.

On suburban lines out of Mayence a trial has been made since last spring of five passenger cars driven by accumulator batteries, which for such service had dropped out of sight for some years. These cars are interspersed among the regular steam suburban trains. They make round trips over lines 7.6, 12.7 and 13.2 miles long, respectively, and their batteries must be charged after each round trip, requiring 40 minutes after the two longer runs and 25 minutes for the shorter one. By the end of September these cars had run 60,737 miles, and there had been no irregularities in traffic due to them. The builder of the cars undertook their maintenance, and no data as to their economy are given.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

VI.

The Normal Type of Steamship Line Organization.

It has been stated that nothing will so prolong the life of a person advanced in years as an annuity. The even and absolutely dependable income gives a certainty, repose and peace that produce a new lease of life. A similar dependable income is about as wholesome and as important for the healthy development of a business corporation as for the individual. The transportation business is uncertain in the amount of its business and its income, so much so that any change tending toward steadiness of business is eagerly sought by the managers of these enterprises. In this fact lies the explanation of much of the recent growth and development of these enterprises.

It is evident that a short railroad serving a small territory, sharing the plenty resulting from good harvest and want of the meager harvests, has much less prospect of steady business than a larger road, serving more territory where local variations tend to be equalized. The strife for regular freights has another phase in the terminal connections which can be made by the company. It is again fortunate, if some other company will promptly carry the freight away from its terminal and pass it on to other territories. It is better yet if some second company delivers goods at its termini for carriage over its lines.

In obedience of these economic forces, transportation corporations may be said to have a law of expansion. Within limits of easy control, the larger they are and the wider their territory, the safer and more reliable is their business. This expansion tends to go on until the carrying unit embraces an economic unit so that there are no commercial wants of the people along the lines that cannot easily be supplied by the great carrier. The people want the ship, and desire to receive goods on through bill of lading with prompt service. The carrier strives to furnish these opportunities. In response to this law the past 40 years have been a period of astounding consolidation and enlargement of the units of management in transportation by land and by sea. Single steamship companies regularly circumnagivate the globe. This has been far eclipsed by the actual labor and capital involved in the operations of railroads which have performed the greater work of crossing an entire continent and establishing subsidiary steamship lines. Connecting railroad lines have been brought closer by through freight agreements, by the leases of long term, 99 or 999 years, and by outright purchase. Great trunk routes have thus been established, branches built, subsidiary industries established, rival trunk lines bought entirely or controlled by majority stock purchase, or by community of interest in which the same men are on several boards of managers so that mutual agreements prevail.

When the railroad was first introduced, people thought of the various roads as connections between certain towns, which was indeed their only early goal. During the past 70 years we have seen the railroad develop from a set of links connecting two or three semi-adjacent cities into vast systems consisting of trunk lines and many branches or feeders.

Principal Services of the Hamburg-American Packet Company.

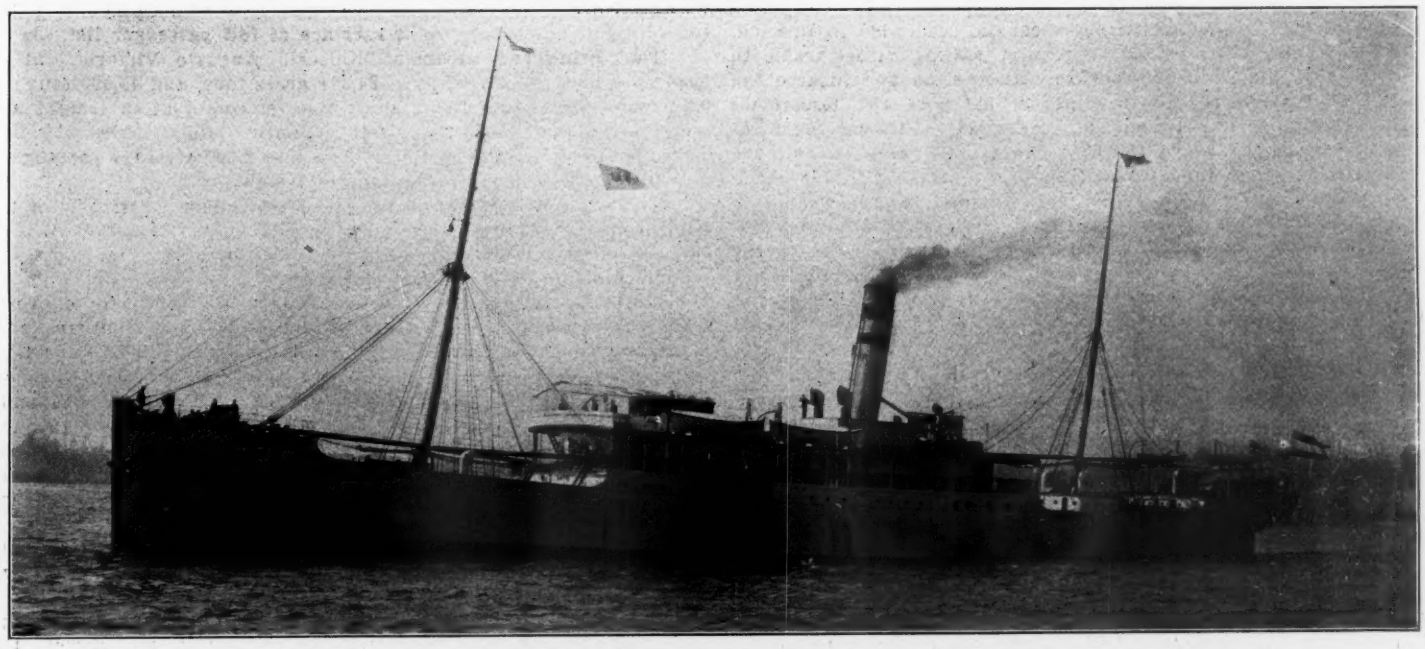
While we have long since learned to think of railroads as systems, we are still prone to think of steamship lines as doing what the early railroads did—connecting two places. This idea must be discarded. The law of growth among steamship lines works surely to the development of trunks and branches, a development which has already taken place, although the branches are fewer than upon railroads. The improvement of the steamer and the use of the ocean cable gave the needed regularity, dependableness and knowledge for the organization of ocean commerce and transportation into a regular and systematic service akin to that of the railroad. The great ocean lines sail with precision and regularity. To supply these great lines with freight, their managers have been compelled to establish smaller lines to supply and distribute the

necessary cargo. The largest transatlantic lines are, without exception, thus equipped at one or both of their termini. The North German Lloyd and the Hamburg-American connect at their European ends with lines running to South America, East Asia and other distant parts of the world. They also connect with smaller lines plying to the nearby European ports and with steamers on the German rivers. These two German companies carry the same system even further. Their trunk lines to East Asia are fed at Singapore and other eastern ports by lines of smaller German steamers which traverse the eastern archipelagoes and the Asiatic coasts and rivers, collecting cargo for the trunk line stations of the large steamers bound for Bremen or Hamburg, at which ports it is distributed by the European distributors referred to above or sent on to America by the transatlantic lines. The Wilson Line from New York to Hull connects in that city with an enormous fleet of small steamers which thread the coasts of the North Sea and reach all ports of importance in Scandinavia and along the Baltic. Some of the other British transatlantic lines connect with British coasting lines and with the lines to Australia and other British colonies. The French and Italian lines are fed by fleets of Mediterranean coasters and transoceanic liners at Havre, Marseilles and Genoa. The Cunard Line, giving a service from New York to Liverpool and from New York to southern Italy and Fiume, Austria, has a line connecting Liverpool and Fiume. These steamers call at more than 20 ports and gather freight which is to be transferred at the ends of the route to the next steamer bound for America. Other examples of this systematic trunk and feeder development of ocean service might be mentioned; but they would show no feature differing from the development of the examples cited or from the railroad and its branches except that the ocean service of single companies at times circumnavigates the globe and covers a much wider scope of territory than any railroad system the world can ever have.

Steamship Kaiserin Auguste Victoria; Fast Passenger and Freight Service.

The world's greatest steamship company, the International Mercantile Marine, differs from the other giant organizations, such as the Hamburg-American, North German Lloyd, and Peninsular & Oriental, in that, while exceeding any of them in tonnage, it covers a smaller area with its services. This results from the fact that it was formed for a different object. The three European companies referred to are older, and were built up gradually, ship by ship, service by service, as the traffic grew and the service expanded to meet it. One improvement or extension of service to get freight demanded another to dispose of it. The Mercantile Marine Company grew differently. It was the last step in a series of consolidations of equals. The American Line had taken over the Inman Line in 1884. It had later taken over the Red Star Line and become the International Navigation Company. This company now consolidated with four other great lines for the purpose, not of extending service, but of making living rates at a time when severe competition made general loss. Its genesis, therefore, differs profoundly from that of the other great companies.

In some respects the law compelling consolidation and the establishment of feeders works with stronger force among steamship lines than among railroads. The railroad runs through certain territory where it has scores of stations supplying it with traffic and many of them are so situated that they control freight that can find no other suitable outlet. This much the railroad has beyond per-



Steamship Alleghany; West Indian Service.

adventure. The steamship line that serves one port as many of them do, must find its freight there or nowhere, and in the port competition is free and the freight may go to any rival. If it has some coasting lines bringing in freight, the situation is instantly different.

The company that runs a line on one route only is at the mercy of any local fluctuation in traffic. A strike even might spoil the profits of a quarter, so might a drought or any local uncontrollable disturbance. Then, too, there are seasons in nearly all trades during which the traffic is abundant and others in which it is scarce. Just after harvest time, wheat, corn and cotton go forward in quantity and the trade falls away to small proportions as the next harvest approaches. The steamship company with many lines can have its annual work evened up by seasonal prosperity in one quarter as dulness comes in another. Instead of having ships half idle on its one dull route, it can shift them to the prosperous route. As the vessels get old and antiquated for the finer routes they can be shifted to a slower and inferior route. The greatest advantage, however, is the picking up of freight for the main lines, just as the branch roads feed a main trunk railroad.

All these forces are welding the ocean carriers into ever-growing systems. There are, of course, multitudes of small steamer lines as there are many small railroads, but there is a steady tendency toward their consolidation into well articulated groups.

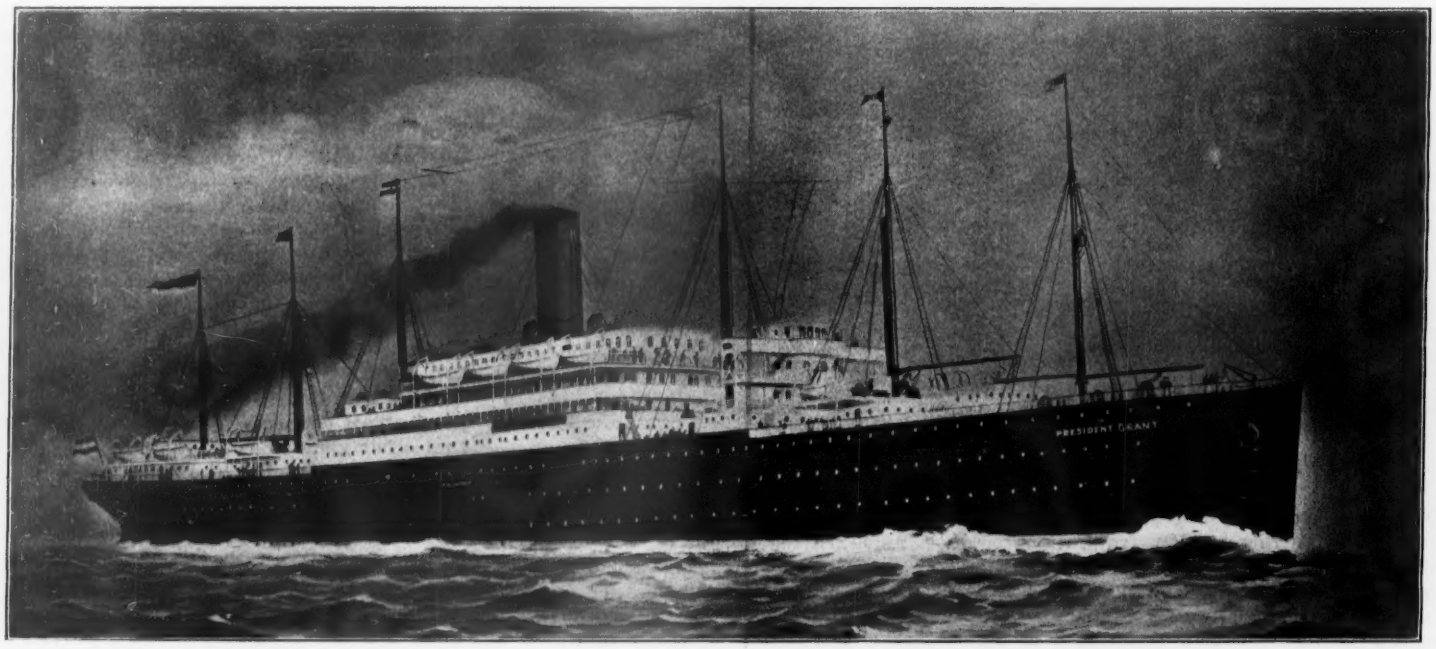
The reading public has been thinking of steamship lines as lines, as entities, when really they are parts of systems, and many of the North Atlantic lines have from their inception been but an outreaching arm of a European system.

The North German Lloyd was formed in 1856-7 by the consolidation of nearly all the steamship lines, local and otherwise, in Bremen. Since 1827 there has been fairly regular sailing vessel traffic to New York carrying emigrants one way and cotton and tobacco the other. Now that nearly all the lines of the port, the assemblers and distributers of this trade, were consolidated, it was the most natural thing in the world for the company to reach out for the American traffic—and they reached again and again. In 1858 they started the steam service to New York and in 1866 it was made weekly, 1868 a line was sent to Baltimore, in 1869 to New Orleans, 1870 to the West Indies, 1875 to Brazil and Argentina, and so the company has gone on reaching out until with its partner, the Hamburg-American Company, it practically covers the world. The strong hold it had in the local trade of Bremen and nearby waters enabled it to beat off the four American attempts to establish service to Bremen 1866-1870, as it had the previous one of 1858-61.

The Hamburg-American Company, which in the minds of some may be thought of as a New York-Hamburg Line, is really one of the leading factors in the carrying trade of all America and of the old world as well. This one company dominates the metropolitan city of Hamburg and connects it with Montreal, Portland, Boston, New York, Philadelphia, Baltimore, Newport News, New Orleans and Galveston in the eastern United States. It sends steamers to Mexico, Central America, Panama, Colombia, Venezuela and the Lesser and Greater Antilles. They go to the Amazon, to the ports of Central and South Brazil, to Uruguay and Argentine Republic, to Chili and Peru. In Europe they circumnavigate the British Isles, skirt the coasts of France, Spain, Portugal and Italy, to the head of the Adriatic; they go in the Baltic to Russia and Sweden and out in the Atlantic to Iceland and North Cape and on to Arctic Spitzbergen. In Africa it touches at Alexandria and down the whole west coast as far as the mouth of the Congo. In Asia it serves Aden, the ports of Arabia, Persian Gulf, Ceylon, Calcutta, Straits Settlements, China, Korea, Siberia, Japan and finally and possibly most remarkable of all it sends steamers thence across the Pacific to Portland, Oregon—a grand total of 57 services crossing every ocean, touching all continents and every commercial zone.

The illustrations accompanying this chapter show the more important of the Hamburg-American Company's* 68 lines and services—an example of equalized traffic through world organization—and also a group of the company's steamers selected as being typical of four distinct types of service. The express steamer "Deutschland," 23 knots per hour, for some years holder of the Atlantic racing record, is 661 ft. long, and of 16,502 gross tons register, with 37,000 h.p. This vessel can carry 467 first class passengers, 300 second class, 300 third class, but owing to a large crew and coal consumption and fine lines, she can carry less than 1,000 tons of express freight.

The "President Grant" represents a combination freight and passenger ship purchased and fitted especially for the Hamburg-New York emigrant trade. This steamer, 616 ft. long, gross tonnage of about 17,540, can carry 324 first class passengers, 125 second class, 1,000 third class and 2,320 fourth class on the middle and lower decks. This enormous steerage capacity is the direct result of the enormous westward movement of emigrants and the vessel can, at will, fill a large part of its space with low class passengers



Steamship President Grant; Designed Especially for North European Steerage Trade.

or with freight, having at times a capacity of something like 15,000 tons freight, but this at some sacrifice of full passenger list.

The twin-screw steamer "Kaiserin Auguste Victoria," at 17 knots per hour; 677½ ft. long, 24,581 gross tons, and 43,000 tons displacement, represents the highest type of combination freight and passenger steamer for the North Atlantic. She carries 550 first class, 350 second class, 300 third class and 2,300 steerage passengers, and in addition, about 10,000 tons of freight.

As a subsidiary type we show the "Alleghany," formerly of the Atlas Line; 2,494 gross tons, 2,000 h.p., 12 knots. This vessel is in the New York-West Indian service. It can carry 60 first class passengers and nearly 2,000 tons of freight.

While the Hamburg-American stands as the high type of world traffic development, it does not stand alone, and it differs only in degree from many others. In 1874 the Anchor Line, not particularly well known, because of its chiefly freight service from Glasgow to New York, was heralded by its admirers as the largest steamship company in the world, but it had not become so solely through its 18 years of New York service. Before the New York service began, the Anchor Line was great in the British Mediterranean trade, and for nearly a decade the New York service was a secondary interest to the Mediterranean service from which it had sprung.

The consolidation of a number of local European lines may be taken as the signal for the founding of a new line to some foreign land. In 1875, a period of great depression and failure and, therefore, of ease of consolidation by the hands of the strong, the Wilson Line from Hull to New York was started, but it was merely the

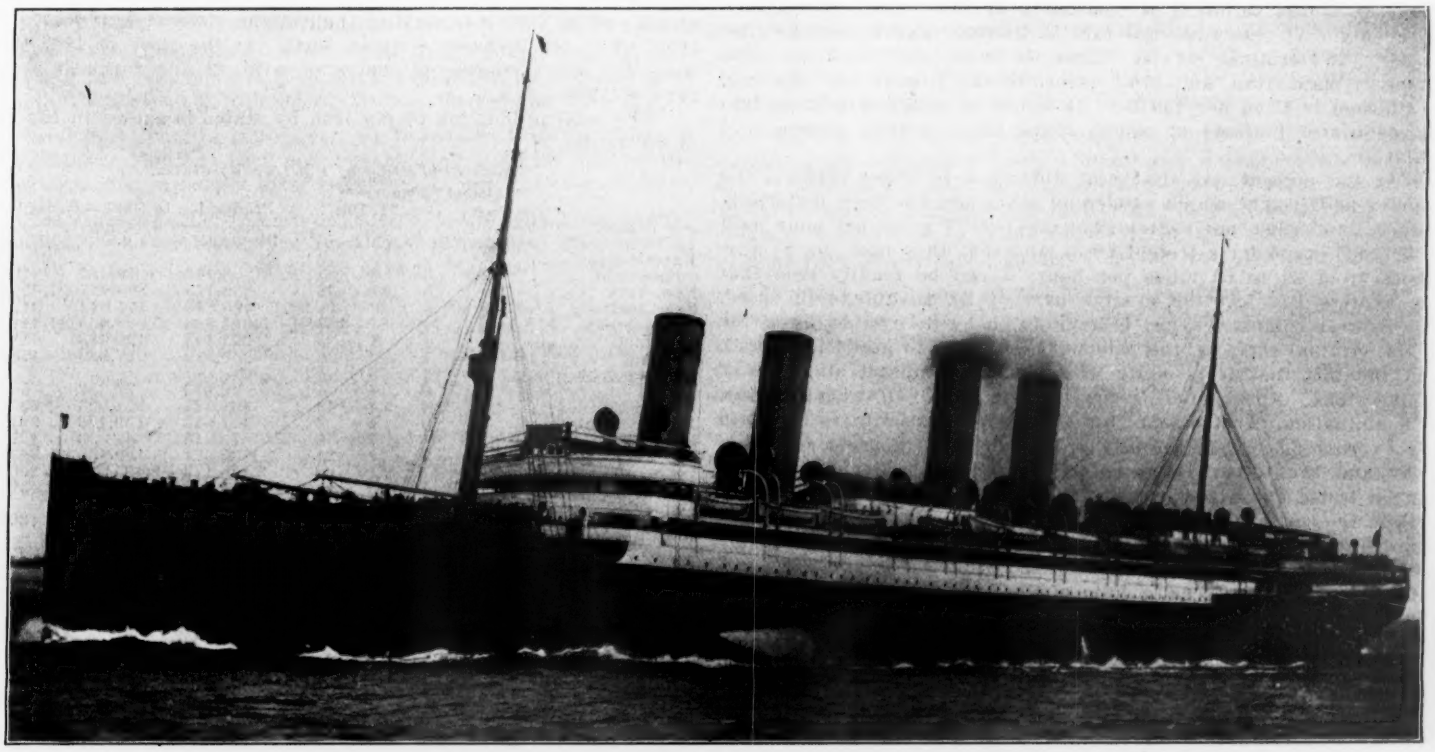
*Hamburg-Amerikanische Packetfahrt Aktien Gesell.

offshoot and distributor for one of the largest collections of coasting steamers that ever fed a port. The head of this firm is often called the largest ship owner in the world. As long ago as 1891 the firm had 140,000 tons of steamers, of which 40,000 tons were trading to the Mediterranean, others to South America, Hindustan and Australia. The Leyland Line, which started a service from Liverpool to Boston in 1876, was an old established firm with a large Mediterranean trade; and the Johnson Line to Baltimore was started in 1880 by a firm with a great business between Liverpool and the Danubian ports. The White Star Line on the Atlantic was the noble effort of old Australian traders, and they are Australian traders yet, despite Atlantic success and the Morgan merger into the so-called shipping trust.

The largest Italian Line, the Navigazione Generale Italiane, was formed in 1881 by the union of smaller lines, and in 13 years it had 105 steamships operated on many seas. A few years ago, the numerous small companies plying about the island capital of Copenhagen united to form the United Companies of Copenhagen and with that basis for distribution they began at once to send steamers to the far East to take their freight and get something for them to distribute.

With these facts and tendencies of line traffic organization in view, it becomes very plain that the forwarding of American goods by foreign steamers was the most natural thing in the world. Not only were the existing lines well equipped and located to render the service well, but in dozens of cases the goods could and did pass from the foreign country to Europe and thence to the United States and vice versa in the lines of the same company. One of the lines was merely serving as the feeder to the other as it was meant to do when it was created.

(To be continued.)



Steamship Deutschland; Type of North Atlantic Express Service.

The Express Business.*

In the early days the stage driver was the expressman. He was indeed an important individual, next to the parson and the judge; not, however, below even them in his own estimation. He carried all sorts and kinds of big boxes, little boxes, band-boxes and bundles. He put them in the boot under his feet, and the letters, bills, orders, etc., into his bell-crowned hat. Many stage drivers became bald in consequence of this practice. The stage driver not only carried the packages, but executed commissions of various kinds at the terminal of his route, and, generally at least, the charges were his perquisite. Long prior to 1820, the grandfather of your speaker was a bank messenger, traveling on horseback, with saddle-bags and a pair of trusty horse pistols, to and fro between the scattered banks and bankers in Central New York, carrying what they considered large sums of money, and protecting his treasure at night in the rude roadhouses where he slept by a stout piece of steel with a fork at each end, one of the ends being forced into the floor and the other end into the door.

The bud of express evolution bloomed in the hand of William F. Harnden, of Boston, about 1839. The great Adams Express Company of the present day is the full-blown flower from that bud. Harnden's office in New York was at No. 1 Wall street.

As far as records are available, Harnden was the first man to make a contract with a railroad for the carriage of express matter. It seems quite an insignificant transaction now; less than 100 miles of railroad; but in the act an acorn of principle that has produced the oak, whose inception, growth and existing status has received the recognition of the Supreme Court of the United States. This contract differentiated Harnden from all who had gone before, and even to this day differentiates the express companies of the United States and Canada from all other freight forwarders in the world.

Let us glance at the statements of the Supreme Court in the Express cases of 1885. The Court said that the express business had become a public necessity, ranking in importance with the mail and the telegraph; that it was used in every conceivable way and for every conceivable purpose by the people and by the government; all have become accustomed to it, and it cannot be taken away without breaking up many of the long settled habits of business, and interfering materially with the conveniences of commercial life. That there never had been a time since the express business was started that it had not been encouraged by the railroad companies, and no railroad in the United States had ever refused to transport express matter for the public upon the application of some express company of some form of legal constitution; that every railroad has recognized the right of the public to demand transportation by the railroad facilities which the public has permitted to be created. The Court further noted that the transportation required is of the kind which must if possible be had for the most part on passenger trains; that it required not only speed, but reasonable certainty as to the quantity that will be carried at any one time; as the things carried are to be kept in the personal custody of the messenger or other employee of the express company, it is important that a certain amount of car space should be specially set apart for the business, and that this should, as far as practicable, be put in the exclusive possession of the expressman in charge. As the business to be done is express, it implies access to the train for loading at the latest and unloading at the earliest convenient moment. By inference at least, the Court held that it was the duty of the railroad to furnish express facilities.

The language of the Court is that the railroad company performs its whole duty to the public at large, and to each individual, when it affords that public all reasonable express accommodations. If this is done, the railroad owes no duty to the public as to the particular agencies which are selected for that purpose; the public requires the carriage, but the company may choose its own appropriate means of carriage, always provided they are such as to insure reasonable promptness and security.

It was also noted by the Court that it was neither averred nor

*From an address before the Traffic Club of New York, by C. H. Crosby, Vice-President and General Manager of the United States Express Company.

shown that any railroad company in the United States had ever held itself out as a common carrier of express companies; that is to say, as a common carrier of common carriers; and then the Court went on to show, at some length, that when a railroad took an express company on its lines it was always under some form of contract. There are many interesting statements in this celebrated decision, but I have cited enough to prove my statement of the great advance made in the evolution of the express, when starting with Harnden, the carriage of the goods by the railroad was done under contract; and besides this, the principle was fixed at that early date that one of the considerations of the contract was the assumption by the express company of the risks of carriage and liability for delivery to consignee.

Outside of the facilities granted the express companies of transportation under contract, another feature of equal importance to the public, and of far greater expense to the express, is that of terminal and accessorial service which, subject to a very slight exception, distinguishes (at least in the United States) the express from the freight. Terminal expenses did not trouble Harnden at first, as for a long time he carried all his express matter in a carpetbag; but the growth of the business soon compelled him to procure horses and wagons, offices, bookkeepers, clerks and all the items of terminal service.

The tremendous increase in terminal service rendered by the express companies to the public is little known. To illustrate its phenomenal growth, there was quite a discussion in June, 1868, about extending terminal service north of Fourteenth street, New York City. At that time the rate to Chicago was $5 per 100 lbs. To-day the terminal service covers Greater New York to 181st street in Manhattan, and 170th street in the Bronx; and the rate to Chicago is $2.50 per 100 lbs. It would be wearisome to go into the details of increase of wages, rents, taxes, horses, wagons and materials.

At the present day the great difference in speed between the express and freight which existed 40 years ago has been materially reduced, and when one reflects that eight to 15 miles per hour used to be good speed for a freight train, and that they now run at anywhere from 25 to 50 miles per hour, it can be readily seen that the express has lost the greater part of its advantage in speed. The express company to-day is hanging on by its eyelids, by virtue of its terminal services, the personal care given to goods in transit, and the fact that it is ready to accept and transact all kinds of commissions. An example is goods carried C. O. D., with privilege of examination. Instruments for a brass band used to be tested in the express office, but recently shippers allow them to be taken away and the torture more widely distributed. Medicines, even, can be tested for a few weeks; if a cure is not effected, put the cork in the bottle and the express will carry it back. Suits of clothing can be tried on in the office, and rumor says that even fighting cocks have been tried out in front of the counter. If you want anything bought, from an early folio of Shakespeare to a bulldog or a Plymouth Rock hen, you merely need mention your wants to the express agent, and he will tell you where to buy, and generally be able to tell you the cost of the article. Information wanted: That is where the express agent comes out strong.

The line of demarcation between the freight and the express is drawn most sharply and effectively by the difference in price of the respective services. The express company cannot escape the cost of terminals, and the cost is just the same whether the goods have come ten miles or a thousand. The terminal costs in New York are just the same on a package from Jersey City as on one from Alaska. The result is frequently that the relative rates of express and railroad exhibit the widest variation. Quite recently the newspapers reported that a member of one of the western railroad commissions said his state did not want any express companies. They had found out that the railroad charged the express company 50 per cent. of what the express company charged the public; therefore, the railroad should do the express business at half the existing rates. This report may not be true, but I have not seen it contradicted.

The wonderful improvement in the construction of roadbed, bridges and rolling stock, and the consequent vastly increased speed of freight trains has gone far to deprive the express of that advantage, and has caused it to lose large lines of traffic formerly enjoyed by it. They are now carried by all sorts of special freight cars and arrangements. In great measure the express business has gone back to the days of its founders. It is largely a business of small parcels, combined with various side lines of collections, money-orders, commissions, etc. Our average transaction, great and small, is not over 50 cents gross. The time when the express practically did all the fast service has departed, and there is no probability that it will ever return.

There can be no competition between the express department of a railroad, or on a railroad, and the freight department of the same road. The severe terminal and accessorial expenses of the express effectually prevent it from meeting even part way the regular freight rates. The slower time and the terminal expense which must be borne by the shipper, prevent the freight from encroaching to any great extent on the express. One supplements the other, and together they give to the American public a service that, with all of its occasional imperfections, is not excelled by any service on earth, and equaled by very few.

Pig Iron Production in 1907.

The Bulletin of the American Iron & Steel Association gives the following statistics, received from the manufacturers, of the production of pig iron:

The total production of pig iron in the United States in 1907 was 25,781,361 gross tons, against 25,307,191 tons in 1906. The following table gives the half-yearly and yearly production in gross tons during each of the last five years:

Period.	1903.	1904.	1905.	1906.	1907.
First half	9,707,367	8,173,438	11,163,175	12,582,250	13,478,044
Second half	8,301,885	8,323,595	11,829,205	12,724,941	12,303,317
Total	18,009,252	16,497,033	22,992,380	25,307,191	25,781,361

The pig iron production of 1907 exceeded that of 1906 by 474,170 tons, an increase of 1.9 per cent.

Production in the second half of 1907 was 1,174,727 tons less than in the first half of the year. The whole number of furnaces in blast on December 31, 1907, was 167, against 359 on June 30, 1907, and 340 on December 31, 1906. The number of active furnaces at the end of 1907 was smaller than at the close of any year since 1896, when 159 furnaces were in blast. At the close of 1907 there were 276 idle furnaces, as compared with 89 idle furnaces at the close of 1906.

The total production of pig iron by states is shown in the subjoined table:

Total Production of Pig Iron by States.

States.	Blast furnaces: In blast June 30, 1907.	Blast furnaces: Dec. 31, 1907. In.	Out.	Total.	Production in 1907.—Gross tons of 2,240 lbs.* First half.	Second half.	Total.
Massachusetts	2	2	0	2	8,746	10,373	19,119
Connecticut	2	3	0	3			
New York	17	9	17	26	859,125	800,627	1,659,752
New Jersey	8	5	6	11	195,245	177,944	373,189
Pennsylvania	141	70	87	157	5,964,884	5,383,665	11,348,549
Maryland	4	1	4	5	221,145	190,688	411,833
Virginia	16	7	19	26	260,912	217,859	478,771
Georgia	2	1	3	4			
Texas	1	0	4	4	26,173	29,652	55,825
Alabama	34	15	34	49	861,771	824,903	1,686,674
West Virginia	4	0	4	4	151,643	139,423	291,066
Kentucky	5	1	7	8	79,013	48,933	127,946
Tennessee	14	9	12	21	193,371	199,735	393,106
Ohio	58	17	51	68	2,815,174	2,435,513	5,250,687
Illinois	24	11	13	24	1,263,258	1,194,510	2,457,768
Indiana	0	1	0	1			
Michigan	12	8	5	13	197,330	239,177	436,507
Wisconsin	6	2	4	6			
Minnesota	1	1	0	1	160,045	162,038	322,083
Missouri	2	1	1	2			
Colorado	6	3	3	6			
Oregon	0	0	1	1	220,209	248,277	468,486
Washington	0	0	1	1			
California	0	0	0	0			
Total	359	167	276	443	13,478,044	12,303,317	25,781,361

*Includes spiegeleisen and ferro-manganese.

The production of pig iron in the United States is classified by kinds and by fuels. There were 13,231,620 tons of Bessemer and low phosphorus pig iron produced in 1907, against 13,840,518 tons in 1906, a decrease of 608,898 tons, or 4.4 per cent. The production of basic pig iron in 1907, not including charcoal of basic quality, was 5,375,219 tons, against 5,018,674 tons in 1906, an increase of 7.1 per cent. The production of spiegeleisen and ferro-manganese was 339,348 tons, against 300,500 tons in 1906, an increase of 38,848 tons, or 12.9 per cent.

In the production of the great bulk of pig iron bituminous coal and coke was used as a fuel, the pig iron made by these fuels amounting to 23,972,410 tons, as compared with 23,313,498 tons in 1906, an increase of 658,912 tons, or 2.8 per cent. The production of pig iron from anthracite coal and coke mixed as a fuel amounted to 1,335,286 tons, as compared with 1,535,614 tons in 1906, a decrease of 200,328 tons, or 13 per cent. Anthracite coal alone was used in the production of 36,268 tons, as compared with 25,072 tons in 1906. The production of charcoal pig iron in 1907 was 437,397, as against 433,007 tons in 1906, an increase of 4,390 tons. There were 437,397 tons of pig iron made in California in 1907 with charcoal and electricity.

The total production of all kinds of pig iron in Canada in 1907 was 581,146 tons, against 541,957 tons in 1906, an increase of 39,189 tons, or 7 per cent. In the first half of 1907 the Canadian production was 270,100 tons, and in the second half 311,046 tons. The growth of the Canadian output of pig iron is shown in the following table, which gives the production during the last 14 years:

Years.	Grs. tons.	Years.	Grs. tons.	Years.	Grs. tons.	Years.	Grs. tons.
1894	44,791	1898	68,655	1902	319,557	1906	541,957
1895	37,829	1899	94,077	1903	265,418	1907	581,146
1896	60,030	1900	86,090	1904	270,942		
1897	53,796	1901	244,976	1905	468,003		

GENERAL NEWS SECTION

NOTES.

At the special session on February 1, the North Carolina Legislature passed the 2½c. fare bill.

The new Pennsylvania state railroad commission took the oath of office at Harrisburg, February 4.

The Interstate Commerce Commission expects to send out during this month forms for recording the depreciation of cars.

It is reported that the Pullman Company will abolish the operation of cars between Chicago and Cincinnati, on grounds of economy.

The Chicago, Milwaukee & St. Paul is reported to be receiving 500 inquiries a day about opportunities for location on its Pacific extension.

A prominent locomotive builder calls attention to the fact that orders from foreign countries are just now as scarce as orders from the United States.

It is understood that the Atchison is going to reduce its passenger train service in Oklahoma on account of the two-cent clause in the state constitution.

The House Committee on Interstate and Foreign Commerce is discussing the transportation of high explosives, and heard testimony by Dr. Charles B. Dudley, of Altoona, on February 7 and 8.

The Pennsylvania's suspension on December 15 of purchase of second-class timber has been supplemented by a notice that no ties of any kind will be bought after December 15 until further advice.

It is reported that the Union Pacific has received an inquiry about its motor cars from the Russian Government, with especial reference to the adaptability of the cars to Russian railroad conditions.

On February 7 the 8-in. pipe line, built by John W. Gates and his associates, from Tulsa, Okla., to Port Arthur, Tex., 582 miles, was opened for regular operation. The cost complete is said to have exceeded $6,000,000.

By the last eastbound transcontinental tariff points on the Northwestern Pacific will have the benefit of common point rates to eastern points. Heretofore points north of Santa Rosa have had to pay an arbitrary in addition to the common point rate.

The Governor of Mississippi has sent a message to both houses urging the passage of a two-cent passenger rate, but giving the State Railroad Commission a certain amount of discretion in the cases of individual roads not able to stand the reduction.

Beginning February 16, the New York, New Haven & Hartford will be operated in seven divisions instead of in 10 as heretofore. The divisions will hereafter be known as the New York, Shore Line, Providence, Boston, Old Colony, Midland and Western.

The Western New York Car Service Association handled 65,828 cars during December, 1907, at 587 stations. The average detention was high, being 2.19 days, of which 48 days were required by railroads and 1.71 by consignees. The percentage of cars released within the limit was 86.6.

Officers of the Atchison estimate citrus fruit shipments from the Coast this season at 32,000 cars as compared with 27,000 cars last year. The company has no surplus of refrigerator cars and has leased 1,000 additional refrigerator cars from Armour & Co. at the rate of $1 per day.

A press despatch says that the Harriman Lines in Texas have discontinued their suits to enjoin the Texas Commission from enforcing its whole group of freight rates, in consideration of the withdrawal by the Commission of the 2½-cent passenger rate ordered on the Houston & Texas Central.

The New York Assembly Railroad Committee has ordered by unanimous vote, without amendment, the Wagner Bill providing for a flat five-cent fare from Brooklyn Bridge to Coney Island. The Assembly Committee has apparently learned nothing from the Governor's veto of the Baldwin two-cent bill last year.

The Mexico-St. Louis Special, which has been running since the beginning of the year for the third season from St. Louis to Mexico City via the St. Louis, Iron Mountain & Southern, the Texas & Pacific, the International & Great Northern and the National of Mexico, has been given up for purposes of economy.

An officer of a Mexican railroad warns railroad men of the United States who have been thrown out of employment that Mexico is crowded with American railroad men looking for jobs. He says that until recently there has been a good demand for Americans on the Mexican roads, but that this demand is now filled.

The Senate committee on interstate commerce has made adverse reports on the bills to allow newspaper publishers to accept railroad passes in payment for advertising and to permit railroads to exchange passes or tickets with passenger transfer companies or with other railroads for their officers and employees.

The Lake Superior Car Service Association reports that 5,518 fewer cars were handled in January, 1908, than in January, 1907, but that the recent cold weather has greatly increased the movement of coal, and also of pulpwood and other forest products, depending on snow in the woods to facilitate their movement.

Blueprint copies of the chart showing the position of all the telegraph wires on the Tucson division of the Southern Pacific are being issued from the office of the road master at Tucson. These charts are given to all of the freight conductors on the division and are to be kept in the cabooses for reference when it is desired to use the telephones with which each car is equipped.

The action of the interstate commission in insisting on the railroad companies keeping on file at each station two copies of all tariffs has caused the legal departments of certain roads to instruct their claim agents that rates quoted by agents or employees are given at the risk of the shipper and that clerks making such quotations are for the time being agents of the shippers.

The live stock agent of the Canadian Pacific in the West shows export cattle shipments from Alberta and Saskatchewan to have been 42,960 head in 1907 as against 74,740 head in 1906. Other live stock shipments also fell off materially, shipments of horses decreasing from 19,549 to 11,352; of all cattle from 114,651 to 80,043; of hogs from 30,099 to 29,588 and of sheep from 57,024 to 28,573.

Beginning February 18, the Missouri, Kansas & Texas will issue 1,000-mile books at 2c. a mile in Texas, being the first road to do so in that state. The Texas state commission has approved the issue of the Rock Island and the Colorado Southern two-cent interchangeable mileage books. They can be used in Texas on the Trinity & Brazos Valley, which, however, can collect the coupons at the rate of 2½c. a mile.

The United States Forest Service announces that 150,000,000 acres of forest land in British Columbia have been placed in reserve by the Canadian government. This includes every acre of timber lands of the Province except what has already been leased. The action was taken to check wasteful exploitation of timber resources and to bring the care and cutting of timber more effectually under Government control.

It is reported that the Rosenbaum Grain Co. is going to sue the St. Louis & San Francisco for recovery of $42,000, alleged to be the loss sustained by failure of the railroad to deliver a large shipment of grain to a steamship on which it was booked to be carried to the Black sea. The matter has been under investigation since 1906, and brings up the question whether a railroad is liable to a shipper for delay which causes the shipper's goods to be sold on a falling market.

The transatlantic steamship war is ended, and substantial increases have been fixed upon as a minimum basis for a three-year period. The minimum rates on the Mauretania and the Lusitania have been fixed at $127.50, first class, as against a minimum rate of $72.50 during the rate war. Other passenger steamers take lower rates, but the minimum is higher than usual, and applies throughout the year instead of changing in the winter season. No agreement has as yet been reached about the freight and steerage basis.

On February 5, the Louisville & Nashville, following the action of the Baltimore & Ohio, the Erie and the Southern Railway, reduced the salaries of all employees making more than $250 a month. Those receiving $400 and over are reduced 10 per cent., while those receiving between $250 and $400 are reduced 8 per cent.

The Mobile & Ohio also announces a reduction of 10 per cent. in the salaries of all executive officers, officials and employees receiving $100 a month or more. All employees receiving from $100 to $50 a month are cut 5 per cent., the reductions being effective March 1. Colonel Russell states that among the causes necessitating the changes are the financial crisis and unfair railroad legislation in the Southern states.

Dinner to H. H. Vreeland.

On February 7 a large dinner was given to H. H. Vreeland under the auspices of the New York Railroad Club in recognition

of Mr. Vreeland's long and successful career as President of the club. W. G. Besler, Second Vice-President of the club, was toastmaster, and at the close of the dinner, which was attended by 324 persons, Mr. Vreeland was presented with a silver water pitcher. The speakers of the evening were John F. Deems, William J. Wilgus and George A. Post. Mr. Deems spoke of the foundation of the club and of the helpful part played by Mr. Vreeland in its rapid growth and development; Mr. Wilgus talked on his own subject of electrification, and Mr. Post gave a humorous address on the subject of Mr. Vreeland. Mr. Vreeland replied gracefully to the addresses in his honor and emphasized the point that a man living in the world to-day cannot make a first rate success alone, but must have the help of his friends in order to attain the highest usefulness.

Installation of Dr. Goss at the University of Illinois.

The formal exercises incident to the installation of Dr. W. F. M. Goss as Dean of the College of Engineering of the University of Illinois occurred February 5 in connection with the formal opening of the Graduate School of the University. The exercises of installation included two sessions and a tour of inspection through the laboratories of the College of Engineering.

Among the guests of the occasion were: William McIntosh, representing the American Railway Master Mechanics' Association; J. W. Taylor, representing the Master Car Builders' Association; F. H. Clark and C. A. Seley, representing the Western Railway Club; William Forsyth, representing the American Society of Mechanical Engineers; W. K. Hatt, representing the American Railway Engineering and Maintenance of Way Association; Morgan Brooks, representing the American Institute of Electrical Engineers; O. Stephensen, representing the Engineers' Club of St. Louis; C. F. Loweth, representing the Western Society of Engineers; Robert Quayle, representing the Chicago & North-Western R. R.; T. F. Barton and W. O. Moody, representing the Illinois Central R. R.; C. B. Young and M. H. Wickhorst, representing the Chicago, Burlington & Quincy Ry.; A. F. Robinson, representing the Atchison, Topeka & Santa Fe Ry.; A. L. Kuehn, representing the Cleveland, Cincinnati, Chicago & St. Louis Ry.; George N. Dow, representing the Lake Shore & Michigan Southern Ry.; A. F. West, representing Princeton University; H. C. Hoagland, representing the Illinois Traction System; C. H. Benjamin, M. J. Golden, C. A. Waldo, Stanley Coulter and L. E. Endsley, representing Purdue University; J. J. Flather, F. S. Jones and W. H. Kavanaugh, representing the University of Minnesota; W. H. Siebert, representing Ohio State University; W. D. Pence, representing the University of Wisconsin; C. R. Richards, representing the University of Nebraska; F. L. Bishop, representing Bradley Polytechnic Institute; G. F. Gebhardt, representing Armour Institute of Technology; L. E. Young, representing the Missouri School of Mines; E. C. Woodruff, representing Millikin University; Mrs. Laura B. Evans and F. L. Hatch, representing the Board of Trustees of the University of Illinois.

New Jersey Tax Contest Ended.

New Jersey railroads have given up their contest of the Perkins "Average Rate Main Stem" tax law of 1906, which taxes main stem property at the rate of $18.01 per $1,000 of valuation instead of at the rate of $5 as heretofore. The state treasurer has received more than $2,500,000 of the contested balance due, the principal amounts in arrears having been as follows:

Pennsylvania system	$1,061,089
Jersey Central	552,834
Philadelphia & Reading system	122,152
Erie	176,556
Lackawanna	436,129
Lehigh Valley	237,428

Telegraph Block System on the Wilmington & Northern.

The Philadelphia & Reading is about to install the telegraph block system on its Wilmington & Northern division, single-track, from Birdsboro, Pa., to near Wilmington, Del., 60.5 miles. There will be 19 block stations, eight of which will be operated continuously and 11 closed a part of each night. Communication from station to station will be by Morse telegraph and semaphore signals will be used. The outlets of long sidetracks will be connected to the nearest block station by telephone.

Offer to Buy Town.

Through Chief Engineer Morris the Santa Fe Railroad Company made a proposition to the state corporation commission, Feb. 4, to buy the entire town of Goodwin, Ellis county, reimburse the residents for all the money expended there and move them bodily and free of charge to the new town of Holstein, which the Santa Fe is exploiting on its Panhandle branch near the Texas-Oklahoma boundary. This would be a cheaper proposition for the company, they claim, than to grant the request of the Goodwin citizens to erect for them a station with the necessary switch and platform facilities, requiring a deep cut of 15 ft. wide and 3,500 ft. long. The citizens had asked the commission to compel the railroad company to build the station when the counter proposition to buy the town was made.—*Topeka State Journal.*

Life on the Prairies.

A Kansas editor, since his pass has been cut off, has dropped the railroad time-tables from his paper and prints in their place this line: "Trains are due when you see the smoke."

Anderson Controlling Altitude Valve.

The accompanying drawings show the improved type of Anderson controlling altitude valve. A former design was described in the *Railroad Gazette* of September, 1, 1905. The present form is simplified. The valve takes the place of a float in maintaining uniform water level in tanks, standpipes and reservoirs. A float is liable to failure through getting either water-logged or lodged in ice formed on the surface of the water. The valve is placed in a pit under the tank or in any other place where it is accessible and protected from frost. The body and top is of heavy cast-iron. The upper part of the body is lined with bronze and the piston is solid bronze with rubber cups and seat.

The longitudinal section shows the main valve closed. When

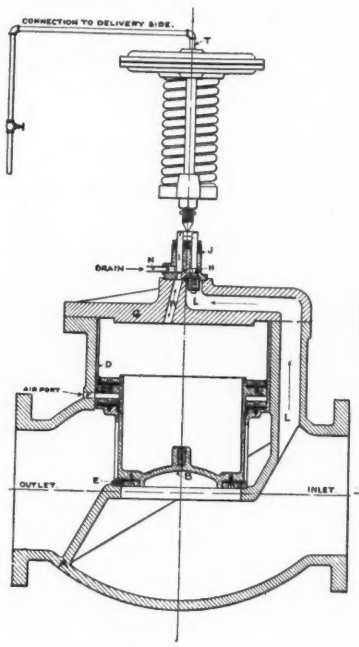


Fig. 1.

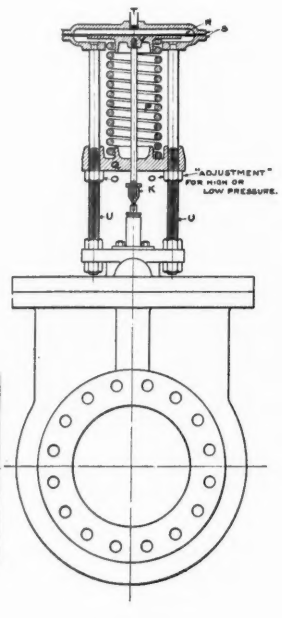


Fig. 2.

water is drawn from the tank, the pressure on the diaphragm, R, Fig. 2, is reduced so that the spring P lifts the valve spindle, K. The high-pressure valve, H, Fig. 1, then closes and the exhaust valve, I, opens, so that the water above the main valve, B, is free to escape through the port M, and the drain N. The pressure of the water in the main inlet pipe now lifts valve B and water flows into the tank. The main valve is cushioned in opening by the water above it which can escape but slowly through the small drain. As the valve moves upward it draws in, through the port, F, air which cushions the valve when it afterwards closes. When the water level in the tank has been restored, the pressure, through the pipe T and diaphragm R, closes the exhaust valve I and opens the valve H. Water now passes through the pipe L and the port M and puts the same pressure per square inch on the top of valve B as there is on the bottom. The top having a greater area than the bottom, the valve closes and shuts off the water from the tank.

The valve is made by the Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.

"Rights of Trains" a Text-book.

The University of Illinois has adopted as a text-book H. W. Forman's "Rights of Trains on Single Track," published by the *Railroad Gazette.*

A New German Cab Signal.

According to a report from Consul T. J. Albert, of Brunswick, Germany, the Prussian railroad administration now has in use a cab signal giving both a visual and an audible indication, in which

the connection between the roadside fixture and the apparatus carried in the cab of the locomotive is made by means of a bristly broom of pliable copper wire, carried on an arm projecting from the side of the locomotive and rubbing against two parallel iron bars fixed near together and mounted along the track for several yards. This roadside apparatus is fixed at about 100 meters (330 ft.) in the rear of the ordinary visual signal, and its sole purpose is to warn the engineman that he is near such signal and must look out for it. Thus knowing the precise location of the roadside signal—presumably a distant signal—the engineman will be on the alert so as to bring his train to a stop at once in case, by reason of fog, he fails to see the visual signal.

The Anti-Monopoly Crusade.

Uncle Jeptha—The railroad is sellin' tickets ter Chicago fer four dollars. They can't afford ter do it at that price.

Uncle Steven—No; that's what Hiram said. He went an' bought nine tickets an' didn't use one of 'em. Said if he had money enough he'd keep on buyin' tickets till he'd busted up the hull railroad monopoly. He's got it in fer the trusts, Hi has.—*Puck.*

Tractive Effort of New York Central Electric Locomotives.

The accompanying chart, compiled by Muralt & Co., New York, shows the comparative drawbar pull, in pounds, of a New York Central electric locomotive and a Pacific locomotive, at various speeds; that of the former is shown in white. Both locomotives are designed for about the same speed—35 miles an hour. The electric engine weighs 95 tons, with 70 tons on drivers, and the Pacific locomotive

Comparative Drawbar Pulls of Electric and Steam Locomotives.

weighs 171 tons, with 70 tons on drivers. The former can exert its full power up to 35 miles an hour, after which its efficiency falls, primarily because of internal reactions in the motors. The efficiency of the steam engine decreases rapidly at speeds over 15 miles an hour.

Exports of Rails, Cars and Locomotives in 1907.

The value of exports of rails, cars and locomotives during 1907 was $30,800,000, which is the largest on record. The value of these exports from the United States in 1906 was $24,700,000, which was the previous high record. The exports during 1907 were almost equally distributed in value between rails, cars and locomotives.

Mexico bought more than $1,700,000 worth of cars, $1,500,000 worth of locomotives and over $860,000 worth of rails. South America took over $2,600,000 worth of cars and $3,000,000 worth of rails. British North America bought nearly $1,500,000 worth of cars and $2,000,000 worth of rails. Locomotives valued at over $1,000,000 were exported both to Mexico and to Central America.

The following table shows the value of the exports of these three items during the last two years:

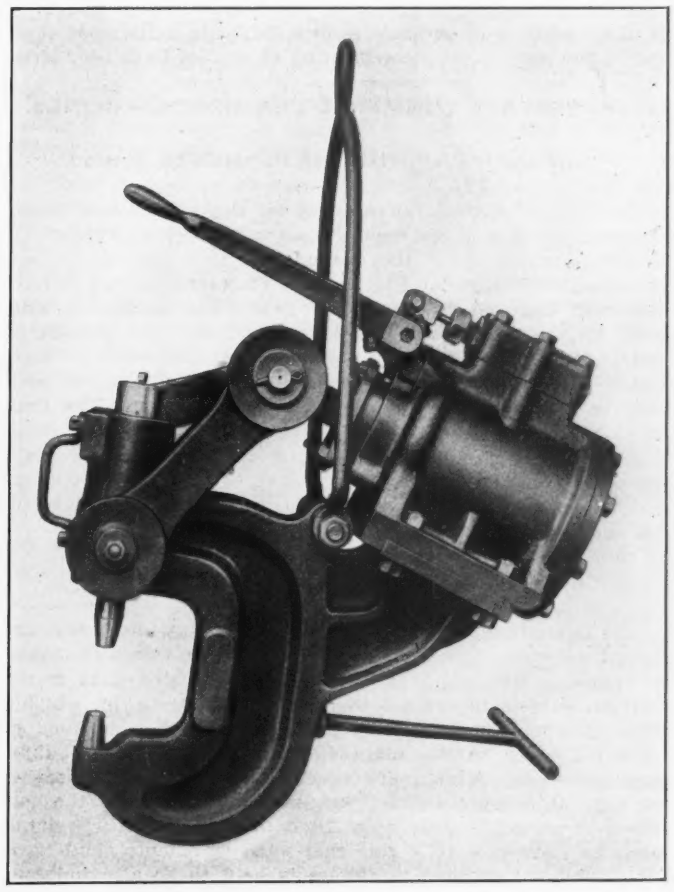
	1907.	1906.
Rails	$10,411,000	$8,903,000
Cars	11,332,000	8,367,000
Locomotives	9,080,000	7,430,000
Total	$30,828,000	$24,700,000

Pennsylvania Stockholders.

The Pennsylvania announces that on January 4, 1908, its stock holdings numbered 57,226, an increase of 16,370 for the year 1907. During the year the average holdings decreased from 150 shares to 110 shares. The number of women stockholders increased from 19,282 to 26,471, and the European investors increased from 7,753 on December 31, 1906, to 9,149 on December 31, 1907. In addition to the figures quoted above there are also 20,793 stockholders in the subsidiary companies; 11,111 for the Lines East and 9,682 for the Lines West.

A Portable Compression Riveter.

On heavy work it is economical to use a portable riveter. A portable hydraulic riveter is not practicable because high pressure water lines are unwieldy and the disposal of exhaust water is difficult. An air-driven machine, however, is well adapted to this work, as the air is carried to it by a comparatively light rubber hose. In the compression riveter shown by the accompanying photograph it will be noted that a comparatively small cylinder is used. The necessary pressure is obtained by the toggle leverage and the rivet is driven by one piston movement. The speed of riveting, therefore, depends mostly on how quickly the machine is moved from one rivet to the next. In one case 12,000 rivets were driven in 10 hours. The work was a long plate girder and the machine was hung from a trolley on an overhead runway. The operator had become very expert in moving the machine from one rivet to the next, the spacing being equal, and several heater-boys kept the



Albree Portable Compression Riveter.

holes ahead of the machine full of hot rivets. The rivets were ¾ in. in diameter. The hot dies were replaced by cool ones at given intervals. Under quite similar circumstances 10,000 rivets were driven in 10 hours. These figures are of interest merely to show what actually can be done. The class of work is all important, and on boiler work, where the rivet must be steam-tight and well driven, no such record could possibly be made.

The riveter illustrated herewith is made by the Chester B. Albree Iron Works Co., Allegheny, Pa. It weighs 850 lbs., has 6 in. reach, and drives ⅞ in. rivets.

The Eleventh Avenue Controversy.

The New York Public Service Commission, First District, considers that it is unwise to place a freight line either below or above Eleventh avenue, and recommends that an electric freight structure be built on the so-called marginal way along the North river water front between West street and the piers. The Commission says there is no doubt that an elevated freight road along the river front would some time be of advantage to shippers, although it holds that the present pier uses are such that there is no great demand for freight car connections, as the docks are used more and more for passenger

and package freight, and freight intended for the interior can be cheaply lightered to railroads. The Commission says: "The best available plan would seem to be to let some company build at its own expense—the New York Central if it would undertake the work on more favorable terms than any one else. An arrangement might be made analogous to that made by the authorities for the continuation of the McAdoo tunnel route through Sixth avenue to 33d street, which was substantially that the city could buy at its then value at any time after twenty-five years and in the meantime a fair consideration was made payable to the city for the franchise privileges."

Direct Current in Belgium.

The management of the Belgian State Railroads, after long investigation, has decided to use direct current and the third rail on several miles of road at the Parc de Laeken, near Brussels. This decision was made in accordance with the recommendations of a report by E. Uytboreck, electrical engineer of the government railroads, who some months ago visited the United States and spent considerable time investigating the operation of the New York Central, the New Haven and other installations, visiting manufacturing companies and fully acquainting himself with the state of direct current and single-phase development in this country. The Belgian government has been given a license to use the Wilgus-Sprague type of protected third rail, and orders for much of the necessary materials have already been placed in this country. The road on which this installation is to be made is new, but it is understood that this is the initial step in the electrification of certain lines near Brussels.

INTERSTATE COMMERCE COMMISSION RULINGS.

Midland Valley Need Not Re-establish Station.

The Commission, in an opinion by Commissioner Prouty, has announced decision in the case of Eddleman et al. v. Midland Valley. The complainants asked the Commission to order the railroad to re-establish its station at Elder, Okla. (formerly Indian Territory), which was removed in December, 1906. The complaint was dismissed by the Commission on the ground that the interest of the general public does not require such re-establishment. The Commission further found that the location of this station at Elder would be an unnecessary burden on the defendant. The Commission also declared that if the complainants had a contract with the carrier to locate and maintain its station at Elder, they may perhaps maintain a suit at law for breach of that contract; but that the Commission has no power to award damages for failure to perform such a contract.

Freight to be Billed at Actual Weights.

The Commission, in an opinion by Commissioner Lane, has announced decision in the case of Romona Oolitic Stone Company v. the Vandalia Railroad. The Commission decided that a rule of a carrier, subject to the act to regulate commerce, by which shipments of stone from non-scale points are billed from such points at weights equal to the marked capacity of the cars, subject to correction when weights are taken, is unreasonable, because on such cars as are not in fact weighed before delivery the carriers proceed to collect freight upon such marked capacity weights. A change of such rule to a rule that such shipments shall be billed at the published carload minimum is held to be also indefensible. The Commission ordered the defendant to desist and refrain from showing purported weights upon its billing until such weights shall have been ascertained either by weighing or by some fair method of computation from cubic contents.

Classification of Wire Coat Hooks.

The Commission, in an opinion by Commissioner Cockrell, has announced decision in the case of the Forest City Freight Bureau v. the Ann Arbor Railroad and 58 other carriers in official classification territory. The complainant asked that a change be made by these carriers in the classification of wire coat hooks packed in cases, when shipped in less than carload lots. As the classification now stands, these coat hooks are in the third class, being included in "hardware specialties not otherwise specified." It was asked that they be transferred to the fourth class; but the Commission held that the present classification of these articles in official classification territory is not shown to be unreasonable and ordered the complaint dismissed.

The Commission said that while it is evident that wire coat hooks are but little more valuable than the raw material from which they are made and no more liable to damage in transit, still the present classification is not unreasonable. The comparison as to their value and that of the spring hinges shows a wide discrepancy, but it is not shown that these hinges are typical of the bulk of the articles placed in the third class. It appears, moreover, that many articles of less value than wire coat hooks are also in the third class. It is true that these articles instanced at the hearing by the defendants are generally made of cast metal somewhat more liable to breakage than the wire coat hooks. It does not appear, however, that any considerable loss to the carriers is caused by breakage of these cast-iron hardware specialties.

Freight Bureau Competent to Bring Complaint; Classification of Brushes.

The Commission, in an opinion by Commissioner Lane, has announced decision in the case of the Forest City Freight Bureau v. the Ann Arbor Railroad and others. The Commission held that the bureau, a concern which admits members upon written contract to perform certain services in return for an annual fee, is an association competent to bring a complaint before the Commission under the act to regulate commerce. The fact that it may not be able to answer in costs in case such should be awarded against it on appeal from the Commission to the courts does not take away its right to bring complaint under the act. The Commission decided in this case that the inclusion of wire brushes and brooms, not toilet, in cases in less than carloads, in the first class in official classification is unreasonable. Defendants were ordered to classify such brushes and brooms in official classification territory in the third class.

Grain Differentials from St. Louis and Kansas City to the Southwest.

The Commission, in an opinion rendered by Commissioner Prouty, has announced decision on motion for rehearing in the case of the Traffic Bureau of the Merchants' Exchange of St. Louis v. Missouri Pacific and St. Louis, Iron Mountain & Southern. In the original case the Commission ordered the carriers to cease from exacting for transportation of grain and products thereof from St. Louis, Mo., to Little Rock, Ark., a rate of 18 cents per 100 lbs. on wheat and its products and of 15 cents per 100 lbs. on coarse grains, so far as applied to such transportation after the traffic has been carried by railroad to St. Louis from points outside that city. The defendants were required to put in rates on wheat not to exceed 13 cents and on coarse grain not to exceed 11 cents per 100 lbs.

Defendants filed motion for rehearing on the grounds that the lower rates from St. Louis will necessitate a reduction in rates from western points of production, and that these lower rates will enable the St. Louis merchants to handle grain into territory which is now covered by Little Rock. The Commission refused to modify its former order on these grounds. A third reason was that if the rate from St. Louis to Little Rock was reduced, the Kansas City Southern will reduce its rates to Texarkana and corresponding points. The Commission did not think this was any justifiable reason, but in order to avoid giving any possible color to such action on the part of the Kansas City Southern, decided to make the differential between Kansas City and St. Louis into this territory 1 cent less than its former order contemplated; that is to say, 12 cents on coarse grains and their products, and 14 cents on wheat and its products.

Accordingly the Commission denied the petition for rehearing, but struck off its former order and issued a new order putting in effect these revised rates.

TRADE CATALOGUES.

Mill Type Motors.—The motors described in bulletin No. 4562 of the General Electric Co., Schenectady, N. Y., are the d.c. M D type and the a. c. M I type. They are built in sizes from 30 h.p. to 150 h.p. The d.c. motors, while generally rated at 220 volts, can be supplied for 500 volts with a slight variation from standard speed, and the a.c. motors are wound for either 220 or 440 volts, 25 cycles, three-phase. They are for operating rolling mills, hoists, turntables, conveying machinery, etc.

Lifting Magnets.—The Electric Controller & Supply Co., Cleveland, Ohio, is distributing a well illustrated pamphlet describing several types of lifting magnets for handling iron and steel to and from cars, in shops, in scrap storage yards, etc. Different types are furnished for handling different shapes of material. The pamphlet includes the list of the company's customers of the past three years.

Air-Brake Lubrication.—The Joseph Dixon Crucible Co., Jersey City, N. J., has issued a pamphlet calling attention to graphite air-brake and triple valve grease. It mentions the parts on which this lubricant can be used to advantage, and the lubricating troubles ordinarily experienced with the air-brake system are pointed out and the remedies given.

Illinois Central.—A folder issued by the passenger department

calls attention to the coming Mardi Gras carnival at New Orleans. The folder is illustrated with photographs taken during last year's carnival, and describes train service from various points to New Orleans via the Illinois Central.

Lifting Magnets.—The Cutler-Hammer Clutch Co., Milwaukee, Wis., is distributing a booklet entitled "Lifting Magnets and Recent Improvements in Them." The booklet is a miniature reproduction of *Cassier's Magazine* for October, 1907, in which the article originally appeared.

Roofing.—A pamphlet issued by the Eastern Granite Roofing Co., New York, describes Granite roofing and shows photographs of buildings roofed with it. This material is made of alternate layers of wool felt and granite composition, surfaced on the outside with sea grit.

Second Hand Metal Working Machinery.—List No. 15 of the Niles-Bement-Pond Co., New York, is a catalogue of a large variety of second-hand metal working machines, which the company has for sale. Each machine is briefly described, with dimensions.

Valves.—Jenkins Bros., New York, have issued catalogue supplement No. 1, which describes and illustrates, with price lists, extra heavy gate valves for 250 lbs. working steam pressure and medium pressure gate valves for 150 lbs. pressure.

MANUFACTURING AND BUSINESS.

Robert W. Hunt & Co., Chicago, have established their St. Louis, Mo., office, which is in charge of C. W. Gennet, Jr., at 1445 Syndicate Trust building. Their chemical and cement laboratory will be in the same building.

The Sellers Manufacturing Co., Chicago, maker of railroad supplies and equipment, has bought a 16-acre tract adjoining its present plant. The land lies between north 45th and 47th avenues, adjacent to the St. Paul and the North-Western tracks.

J. W. Duntley, President of the Chicago Pneumatic Tool Co., Chicago, sailed for Europe on Feb. 4 to attend to business matters abroad. It is stated that the January business of the company in America showed a considerable improvement over December.

The usual convention of branch managers of the H. W. Johns-Manville Co., New York, was held in that city from January 29 to February 1. There was a general discussion of the business affairs of the company and on the evening of January 31 a banquet was given at the Union League Club.

William J. Seaton, Jr., Second Vice-President of the C. W. Hunt Co., West New Brighton, New York, died at his home at Clifton, Staten Island, on January 18, from typhoid fever. Mr. Seaton was 36 years old and had been with the company for 17 years. He began as office boy and was steadily promoted.

J. F. Donahue, for five years Secretary and Manager of Sales of the New Castle Forge & Bolt Co., New Castle, Pa., has been appointed Western Sales Manager of the Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y., with headquarters in the Commercial National Bank building, Chicago.

The G. Drouve Company, Bridgeport, Conn., at the annual meeting of directors on February 3 elected G. Drouve President and Treasurer, and William V. Dee, Secretary. Mr. Dee, who recently resigned from the *Railway Age*, has been appointed also General Sales Manager. The company makes the "Anti-Pluvius" skylight, the Lovell window operating device, Drouve ventilator, drying stove, etc.

Iron and Steel.

The Pennsylvania has ordered 55,000 tons of rails. Details are given in our editorial columns.

The New York City Railway has ordered 2,500 tons of rails from the Pennsylvania Steel Co.

The Canadian Pacific is said to have ordered 40,000 tons of 85-lb. rails from the Lake Superior Corporation.

It is reported that certain western railroads are in the market for an aggregate of 100,000 tons of rails and that two eastern railroads are also making inquiries.

The Chicago, Milwaukee & St. Paul has ordered 3,000 tons of bridge material from the Pennsylvania Steel Co. According to Chicago despatches, the Chicago, Burlington & Quincy is about to order 1,600 tons of bridge material, and the Great Northern and the Chicago & North-Western have ordered, or are negotiating for, large amounts.

OBITUARY NOTICES.

Richard Tull, Treasurer of the Philadelphia & Reading Railway and the Philadelphia & Reading Coal & Iron Co., died at his home in Philadelphia on February 9.

Charles L. Francisco, for many years Superintendent of Building at the Grand Central Station, New York City, died at his home at Yorktown Heights, N. Y., on January 29.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Baltimore & Ohio Southwestern.—E. W. Scheer has been appointed Assistant Secretary, with office at Cincinnati, Ohio, in place of J. G. Walber.

Canadian Pacific.—W. R. Baker, Assistant to the President, has been appointed also Secretary, succeeding Charles Drinkwater, resigned.

Macon & Birmingham.—S. F. Parrott, Vice-President, has been appointed Receiver by the Superior Court at Atlanta, on petition of the Old Colony Trust Company.

Minneapolis & St. Louis.—W. W. Cole has been appointed Assistant Treasurer, with headquarters at Minneapolis, Minn., in place of Joseph Gaskell, deceased.

Mississippi Central.—John T. Porter has been chosen Treasurer and G. F. Royce, Secretary, both with offices at Scranton, Pa.

Mississippi Valley.—This company operates the Portland & Southeastern under lease. J. H. Byrd is President and M. G. Price, Vice-President and General Manager. Office at St. Louis, Mo.

San Antonio & Aransas Pass.—J. W. Terry has been elected Secretary. He will retain the position of Auditor.

Susquehanna & New York.—W. R. Campbell has been appointed Assistant to the President, with office at New York.

Western Allegheny.—The officers of this road, formerly the Western Allegheny division of the Bessemer & Lake Erie, are: Emmet Queen, President; Thos. Liggett, Vice-President; A. H. Eames, Secretary and Treasurer. Offices at Pittsburgh, Pa.

Operating Officers.

Annapolis, Washington & Baltimore.—Joseph O'Hara has been appointed General Superintendent, with office at Baltimore, Md., to relieve W. E. Slaughter, who continues as Traffic Manager. Henry Donavan is Master Mechanic, with office at Odenton, Md.

Canadian Northern Quebec.—R. S. Richardson has been appointed Assistant General Superintendent, with office at Montreal.

Canadian Pacific.—C. Murphy, hitherto Superintendent of district No. 2, Ontario division, has been appointed Acting General Superintendent of the Lake Superior division, taking the place of F. B. Brady, who is absent on account of ill health.

Fort Smith & Western.—W. E. Crane, Vice-President and General Manager, has resigned.

Gulf Line.—W. T. Hargrett has been appointed Superintendent in place of D. L. Turner, resigned; office at Sylvester, Ga.

Intercolonial.—J. H. Brassard, hitherto chief train despatcher, has been appointed Inspector of Transportation, to travel throughout the company's lines and co-operate with other officers in securing efficient service. John Stewart has been appointed Traveling Inspector of Locomotives and Cars, with similar authority and relations to other officers.

Louisiana Western.—See Morgan's Louisiana & Texas.

Mississippi Valley.—H. L. Pitman is Superintendent; office at Portland, Ark.

Missouri Pacific.—M. M. Richey, heretofore with the Southern Railway, has been appointed Superintendent of the Arkansas division, with office at Little Rock, Ark.

Morgan's Louisiana & Texas.—W. M. Hobbs, hitherto Vice-President and General Manager of the San Antonio & Aransas Pass, has been appointed General Superintendent of Morgan's Louisiana & Texas and of the Louisiana Western, with headquarters at New Orleans, La., in place of E. B. Cushing, assigned to other duties.

Morrissey, Fernie & Michel.—J. D. Hurd has been appointed General Manager, with office at Fernie, B. C.

New York, New Haven & Hartford.—In connection with a radical rearrangement and enlargement of divisions, assignments of Superintendent to the several new divisions are announced as follows: New York, J. P. Hopson, office at New York city; Shore Line, C. N. Woodward, office at New Haven; Western,

C. S. Lake, office at New Haven; Midland, B. R. Pollock, office at Hartford; Providence, J. A. Droege, office at Providence; Old Colony, Andrew Ross, office at Taunton; Boston, A. W. Martin, office at Boston. Each Superintendent will have a master-mechanic.

The new divisions are as follows:

Old Colony—From South Braintree to Provincetown, including the Easton, Fair Haven, Woods Hole, Hyannis and Chatham branches; from South Braintree to Plymouth, including the Hanover, Bridgewater and Plymouth branches; from Braintree to Kingston, including the Nantasket Beach branch; from Mayflower Park, Mass., to Newport, R. I.; from New Bedford to Lowell and Fitchburg, including the Watuppa, Somerset, Middleboro, Marlboro and Sterling branches.

Midland—From Hartford to Readville, including the Hartford terminals; Hartford to Springfield via Melrose; Cedar Hill to Dike street, Providence, R. I., via Willimantic and Plainfield, including the Colchester branch; from Groton, Conn., to Worcester, including the Southbridge branch.

Western—From Bridgeport to Pittsfield, Mass., including the New Haven, Litchfield, Brookfield Junction and State Line branches; from Naugatuck Junction to Winsted, including the Watertown branch; from Hartford to Hopewell, N. Y., including the branch from Waterbury to Meriden; from New Britain to Berlin.

New York—From the Grand Central Station, New York, to Stamford, the New Canaan branch and the line from Harlem river to New Rochelle, including the New York and Harlem river water terminals.

Shore Line—From Stamford to Midway (near New London); New Haven to Turners Falls and Shelburne Falls, including the New Hartford, Holyoke and Williamsburg branches; Cedar Hill (New Haven) to Springfield, Mass., including the Suffield branch; Fenwick to Hartford; Wilson Point to Danbury, including the Ridgefield branch.

Providence—From Midway to Readville, including the Providence terminals, the Providence, Warren & Bristol, the Hope, Pascoag, Valley Falls, Franklin, Ashland, Wrentham, Stoughton, Attleboro and East Providence branches; Boston Switch, R. I., to Worcester, Mass., including the Woonsocket branches.

Boston—From the Boston Terminal Company's connection to Readville on the present Providence and Midland divisions; to Needham Junction; to Cook street; to South Braintree and all intermediate branch lines, including the South Boston freight terminals.

Northwestern Pacific.—W. J. Hunter has been appointed Superintendent of the Southern division, with office at Sausalito, Cal.; and John H. McRae, Superintendent of the Northern division, with office at Albion, Cal.

Ohio River & Western.—J. K. Geddes has been appointed General Manager in place of W. R. Crumpton; office at Woodsfield, Ohio.

Orange & Northwestern.—J. E. Kelly has been appointed Superintendent; office at Orange, Tex.

Quebec & Lake St. John.—Jas. J. Sunderland has been appointed Acting Superintendent in place of James Bain; office at Quebec, P. Q.

San Antonio & Aransas Pass.—W. M. Hobbs, Vice-President and General Manager, has resigned. J. S. Peter has been appointed General Manager.

Tallulah Falls.—J. A. Dodson has been appointed Superintendent in place of W. S. Irwin, resigned; office at Cornelia, Ga.

Western Allegheny.—H. F. Bickell has been appointed Superintendent.

Traffic Officers.

Canadian Pacific.—G. H. Smith, hitherto Assistant General Freight Agent at Vancouver, B. C., has been appointed Assistant General Freight Agent of the Central division in place of W. H. Robertson, who has been transferred; office at Winnipeg, Man.

W. H. Robertson has been appointed Assistant General Freight Agent of the Pacific division, changing places with G. H. Smith.

Chicago, Burlington & Quincy.—See Quincy, Omaha & Kansas City.

Great Northern.—M. J. Costello has been appointed Assistant Traffic Manager, in place of H. M. Adams, resigned; office at Seattle, Wash.

Iowa & St. Louis.—See Quincy, Omaha & Kansas City.

Quincy, Omaha & Kansas City.—A. J. Bandy is in charge of the Freight and Passenger Departments, with the title of General Freight and Passenger Agent; and he has charge of the same department of the Iowa & St. Louis, which road is leased to the Chicago, Burlington & Quincy.

Engineering and Rolling Stock Officers.

Chicago, Rock Island & El Paso.—J. G. McLaren has been appointed Master Mechanic, with office at Dalhart, Tex., in place of J. McDonough.

Chicago, Rock Island & Pacific.—H. F. White, Engineer of Maintenance of Way, has resigned, and the position has been abolished.

Union Pacific.—John A. Turtle, hitherto Assistant Superintendent of Motive Power, has been appointed Master Mechanic of the Colorado division, with headquarters at Denver, in place of E. F. Fay, transferred to Cheyenne, Wyo.

Purchasing Agents.

Chicago Great Western.—A. D. Ward has been appointed Purchasing Agent in place of V. F. De Vinney, resigned. Mr. Ward held the position until he resigned two years ago.

Delaware & Eastern.—K. H. Dunham has been appointed Purchasing Agent.

Mexican Central.—E. V. Dexter has been appointed Purchasing Agent, with headquarters in the City of Mexico. The offices of Acting Purchasing Agent in the city of New York, and Assistant Purchasing Agent in the City of Mexico have been abolished.

Pere Marquette.—W. C. Atherton has been appointed Purchasing Agent; office at Detroit, Mich.

LOCOMOTIVE BUILDING.

The New York, New Haven & Hartford has ordered six electric locomotives from the Westinghouse Electric & Manufacturing Co. They will be similar to those now in use on the road.

CAR BUILDING.

The Atlanta & West Point is ordering accessories for 150 freight cars.

The Atlanta, Birmingham & Atlantic has ordered 188 box cars from the American Car & Foundry Co.

J. D. McArthur & Co., Ltd., Winnipeg, have ordered 50 flat cars of 60,000 lbs. capacity from the Hicks Car & Locomotive Works.

The Texas Interurban Company, which plans to build about 30 miles of road in Texas, is figuring on gasolene motor cars. T. Moore, Elizabeth, N. J., is interested.

The West Chester & Wilmington (*Electric*), which is to build 17 miles of road this spring, expects to ask bids on rolling stock in March. T. E. O'Connell, Wilmington, Del., is President.

The Charleston & Summerville (*Electric*), under construction in South Carolina, will shortly ask bids on rolling stock. W. O. Sprigg, 15 Whitehall street, New York, is Chief Engineer.

The Great Cosmopolitan Shows have ordered four 60-ft. flat cars of 60,000 lbs. capacity from the Mount Vernon Car Manufacturing Co. The special equipment includes: Mount Vernon brake-beams, brake-shoes and wheels.

The Colorado & Southern, as reported in the *Railroad Gazette* of January 10, has ordered for the Denver & Interurban eight interurban motor and four interurban trailer cars from the St. Louis Car Co., for April, May and June delivery. The motor cars will weigh 55 tons, and measure 55 ft. 6 in. long, 10 ft. ¼ in. wide, over all, and 14 ft. 3 in. high from rail. The trailer cars will weigh 35 tons, and measure 53 ft. 10 in. long, 10 ft. ¼ in. wide and 14 ft. high, over all. The special equipment for all includes:

Brake-shoes	Sargent
Brakes	Westinghouse-American
Brasses	Hewitt
Curtain fixtures	Forsyth
Curtain material	Pantasote
Heating system	Consolidated
Journal boxes	Franklin
Paint	Murphy
Seats	St. Louis Car Co. standard
Springs	Railway Steel-Spring Co.
Trucks	American Locomotive Co.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Aberdeen & Ashboro.—The Carthage branch of this road has been opened for business from Pinehurst, N. C., north to Carthage, 13 miles. (Dec. 6, p. 701.)

Blue Ridge Traction.—This company, operating seven miles of electric roads in Pennsylvania, proposes to build extensions to various points aggregating 16 miles. The principal extension will be through Cherryville, Weaversville and Bath. A bridge is also to be built at Alliance. The headquarters of the company is at Bethlehem.

CANANEA, YAQUI RIVER & PACIFIC.—See Southern Pacific.

CENTRAL CALIFORNIA.—See Southern Pacific.

COAST LINE RAILWAY.—See Southern Pacific.

COLORADO & SOUTHERN.—On the terminals that the Galveston Terminal Company is building at Galveston, Tex., for the Chicago, Rock Island & Pacific, the St. Louis & San Francisco, the Colorado & Southern, the New Orleans & Pacific and the St. Louis, Brownsville & Mexico, $850,000 has already been spent filling in and putting up a freight house. About $5,000,000 is to be spent altogether. Over 40 miles of track has been laid and large repair shops, roundhouses and other buildings will be put up. In addition to the six blocks of water front, which the company owns, as a site for extensive shipping facilities, the company has 130 acres of land on which the railroad terminal will be established. About $3,000,000 will be spent for improving the water front, including the dredging of a 30-ft. channel, so that large steamers may load at the railroad docks.

COLUMBUS & ERIE.—See Erie.

COLUMBUS, MAGNETIC SPRINGS & NORTHERN.—This company, which is a consolidation of the Delaware & Magnetic Springs Railway and the Richwood & Magnetic Springs Railway, operates 18 miles of line from Delaware, Ohio, via Magnetic Springs to Richwood, of which a length of five miles was built last year. The company intends to extend the line from Richwood north to La Rue, 12 miles. W. M. Galbraith, President; C. Magee, Vice-President and Treasurer, Pittsburgh, Pa.; H. E. Buck, Secretary, Delaware, Ohio.

CORTLAND & AUBURN.—An officer writes that this company expects to begin grading work early this spring on its proposed line from Cortland, N. Y., northwest via Homer, Scott, Glenhaven and Owasco to Auburn, 36 miles. It has not yet been decided whether the road shall be operated by steam or gasolene. Walter L. Webb, Ch. Engr., 2221 Land Title building, Philadelphia, Pa.

ERIE.—The Columbus & Erie will soon be finished. It is a single-track line from Columbus, Pa., to Niobe, and a double-track line from that point to Lakewood, N. Y., a total of 23 miles. The work was done by Burke Bros., of Scranton, Pa., and J. G. White & Co. About 8.34 miles of this line was finished last year. The line is a part of the improvements being carried out to reduce the grades and improve the alinement of the main line.

EUREKA HILL.—This company has finished its line from Silver City, Utah, via Dragon Hollow to the Beck tunnel and the Colorado mine, and is now in operation hauling ore to Silver City, at which point a smelter is being built by Jesse Knight, President of the company. J. William Knight, Vice-President; R. E. Allen, Secretary and Treasurer, and W. Lester Mangum, Director and General Manager, Provo, Utah.

FLORIDA CENTRAL.—This road is now opened for business from Thomasville, Ga., south to Roddenbery, 13 miles, and from Fanlew, Fla., south to Veren, 12 miles. Work is under way from Roddenbery, Ga., south to Fanlew, 34 miles. (Jan. 3, p. 36.)

GALVESTON TERMINAL.—See Colorado & Southern.

GRAND TRUNK PACIFIC.—Bids, it is said, are wanted March 10 by P. E. Ryan, secretary of the Transcontinental Railroad Commission, Ottawa, Ont., for building the following sections:

District D.—From a point designated on the plans of the commissioners, about 8 miles west of the Abitibi river, crossing in Ontario, west about 100 miles.

District E.—From a point 19½ miles west of the crossing at Mud river, near Lake Nepigon, for about 75 miles.

Bids are also wanted for building 195 miles in New Brunswick and 52 miles in Quebec.

The company, it is said, has settled the differences with the British Columbia government in regard to the lands around Prince Rupert, B. C., and a contract for the first 100 miles from Prince Rupert eastward is to be let within three months.

INDIANAPOLIS, HUNTINGTON, COLUMBIA CITY & NORTHWESTERN (ELECTRIC).—This company, of which William Self, Syracuse, Ind., was the receiver, was sold Feb. 1 by order of the Superior Court of Marion county at Warsaw, Ind., to Melvin A. Peoples, of Chicago. This line is built for five miles from Syracuse, Ind., to Vawter's Park, and has about five miles additional graded toward Goshen, Ind. The company was organized to build an electric line from Goshen, Ind., south via Syracuse, Wawasee Lake and Columbia City to Huntington. Mr. Peoples, associated with Burns & Company, Isabella building, Chicago, plans reconstructing and extending the line as projected.

INTER-CALIFORNIA.—See Southern Pacific.

INTERSTATE RAILWAY (ELECTRIC).—This company expects to start grading this spring on its proposed electric line from St. Joseph, Mo., to Kansas City, 47 miles. Right-of-way secured. Smith H. Bracey, 1606 Tribune building, Chicago, will have charge of the construction work.

JOLIET & SOUTHERN TRACTION.—This company, which last year built about three miles of line in Joliet, Ill., and seven miles from Joliet to New Lenox, expects to finish work on the last named, the Blue Island division, this year; also south from Joliet through Ellwood to Wilmington, 16 miles.

KANAWHA CENTRAL.—This road is opened for business from Broundland, W. Va., where connection is made with the Coal River Railway, to Olcott and Dungriff, five miles.

KANSAS CITY, MEXICO & ORIENT.—The Chihuahua division has been extended from Picachos, Mex., to Falomir, eight miles.

KANSAS SOUTHERN & GULF.—This company expects to build this year an extension from Westmoreland, Kan., to Manhattan, 22 miles. The work will include a 300-ft. bridge over the Blue river. Surveys are made for an extension from Blaine, Kan., to Falls City, Neb., 65 miles. Grading is to be begun about May 1. O. J. Collman, General Manager, Lincoln, Neb., and J. E. Williams, Chief Engineer, Westmoreland, Kan.

KENTUCKY & TENNESSEE.—This company, building from Stearns, Ky., west to Rockcreek, 20 miles, has finished the line to Oz, 10.5 miles. Work on the rest of the line has been indefinitely suspended.

LARAMIE, HAHN'S PEAK & PACIFIC.—An officer writes that contracts are about to be let for some of the work on the extension from Centennial, Wyo., south to Hebron, Colo. Part of the work is being done by J. F. White and some by the company's men. (Jan. 17, p. 105.)

LIMA & TOLEDO TRACTION.—See Ohio Electric Railway.

LINCOLN NORTHERN RAILWAY.—See Southern Pacific.

MANISTIQUE.—This road has been extended from Curtis, Mich., to Wilman, three miles.

MEXICAN PACIFIC COAST.—See Southern Pacific.

NEVADA COUNTY NARROW GAGE.—This company began work last year on a cut-off between Colman Station, Cal., and Long Ravine to shorten its line about two miles. Work is being done by the company's men. Grading finished for 1½ miles and track laid for about three-quarters of a mile. The work includes putting up a steel bridge 190 ft. high and about 800 ft. long, which is to be begun April 1.

NORFOLK & SOUTHERN.—The Columbia branch has been extended from Creswell, N. C., south to Columbia, nine miles.

OHIO ELECTRIC RAILWAY.—The Lima & Toledo Traction, building an extension from Deshler, Ohio, northeast about 30 miles to Toledo, has finished a reinforced concrete bridge 1,220 ft. long over the Maumee river near Waterville. Grading has been finished to the Toledo city line. Work has been suspended, but will be resumed this spring, and the line finished into Toledo this summer. (Dec. 6, p. 701.)

OREGON EASTERN.—See Southern Pacific.

OREGON RAILROAD & NAVIGATION.—This company has opened the Pilot Rock branch for business from Pilot Rock Junction, Ore., south to Pilot Rock, 14 miles.

OREGON WESTERN.—See Southern Pacific.

PENINSULAR RAILROAD.—See Southern Pacific.

PHILADELPHIA & READING.—Bids are wanted February 27 by W. Hunter, Chief Engineer, Philadelphia, Pa., for work in connection with the elimination of grade crossings on the Philadelphia, Germantown and Norristown as follows:

Contract No. 28 car cleaning yard Huntington street.

Contract No. 30 coal pocket yard between Berks and Norris streets (East Side).—(Nov. 22, p. 636.)

PORTLAND, EUGENE & EASTERN (ELECTRIC).—This company, which has projected an electric line from Portland, Ore., via Eugene to a point in eastern Oregon, about 182 miles, has grading work under way from Eugene to Springfield, six miles, and track laid in Eugene for three miles. The work includes putting up three bridges. Under the name of the Salem-Mehama, a line is projected from Salem, Ore., southeast to Mehama, 24 miles. Surveys and rights-of-way secured by Walters Bros., of Salem. The project is financed by A. Welch, of Portland.

PORT SIMPSON & FORT CHURCHILL.—Application is being made for incorporation by this company, with a capital of $100,000, to build a line from Port Simpson, B. C., northeast to Fort Churchill, on Hudson Bay. The incorporators include: W. H. C. Duvall, Surveyor General for Canada; J. Brandon, Victoria, B. C.; H. White, former Mayor of Seattle, Wash.; J. McLaughlin, Los Angeles, Cal.; W. H. Harding, New York; S. Shenstone, representing the Roths-

childs; E. B. Dean, Scranton, Pa., and A. C. Latimer, Washington, D. C.

St. Joseph Valley Railway.—See St. Joseph Valley Traction.

St. Joseph Valley Traction.—This company is building a line from Middlebury, Ind., east via Shipshewana to La Grange; and, under the name of the St. Joseph Valley Railway, from that point via Mongo and Orland to Angola, 43.7 miles. Construction work is about finished with the exception of some grading, on which work will be resumed this spring. Preliminary surveys have been made from Middlebury west to South Bend; also from Angola east to Pioneer, Ohio, and Montpelier. G. T. Moore, General Manager.

Sacramento Valley & Eastern.—This company is building with its own men from Pitt, Cal., to Delamar, 16 miles. Contract for the bridge work let to the Globe Construction Co., of San Francisco. Address T. J. Dearborn, Winthrop.

Salem-Mehama.—See Portland, Eugene & Eastern.

South Dakota Central.—This company has opened for business the extension from Arlington, N. Dak., north to Hayti, 21 miles. (Aug. 30, 1907.)

Southern Pacific.—The report of this company for the year ended June 30, 1907, shows that work was under way as follows:

Grading is finished on a line from Benedict, Cal., to Smeltzer, about six miles, and about seven miles of track has been laid on a line from Empire to Rossi, about eight miles, and the grading finished on the remaining mile.

The Bay Shore Line cut-off, a double-track line from San Francisco to San Bruno, about 10 miles, during the year was finished for about nine miles. The line will be finished during the early part of 1908.

Central California.—Organized to build from Niles, Cal., to Redwood City, about 16 miles. Grading finished on three miles and work in progress on the remainder.

Coast Line Railway.—Building north from Santa Cruz., Cal., about 12 miles; nine miles finished and work on the remaining three miles progressing.

Peninsular Railroad.—Building from Mayfield, Cal., to Vasona, about 16 miles; nine miles graded and grading work under way on the remainder of the line.

Lincoln Northern.—Organized to build a line from Lincoln, Cal., to Dairy Farm Mine, about 11 miles.

On the Inter-California branch line from Old Beach (now Imperial Junction), Cal., on the main line of the Southern Pacific, south to Calexico, 41.36 miles, an extension is building east from Calexico, Cal., through the northern part of the Republic of Mexico to Yuma, Ariz., 55 miles. About 19 miles of track laid and three miles additional graded. Work under way on the remaining 33 miles.

Central Pacific.—A spur track from Tacoma, Nev., to the Ore Bins of the Salt Lake Copper Company, about 3.88 miles, was opened September 6.

Oregon Eastern.—On the 152 miles projected by this company, the surveys between Natron, Ore., and Klamath Falls, and between the eastern side of the Cascade Mountains and Ontario have been finished and considerable right of way secured.

Oregon Western.—Projected line 82 miles. Surveys made from Drain, Ore., via Marshfield to Ward and considerable right of way secured. Grading and tunneling on the line is progressing, and a large part of the steel bridges, rails, ties and other track material for the line were bought during the year.

Texas & New Orleans.—A line from West Port Arthur, Tex., to Port Arthur, about three miles, was opened for traffic on September 15.

Cananea, Yaqui River & Pacific.—On this line, from Empalme, Mex., a point on the Sonora Railway, to Tonichi, about 159 miles, the line from Corral north to Buena Vista, about 18 miles, was opened for traffic in February, 1907, making a total of 82 miles in operation. Work is progressing on the remaining 73 miles. On the extension from Corral southeast to Alamos, about 92 miles, the line from Corral to Velderrain, about 27 miles, was also opened for traffic in February, 1907, and from Velderrain to Navopoa, about 27 miles, was opened in May, making a total of 54 miles in operation. Work on the remaining 38 miles is progressing.

Mexican Pacific Coast.—Building from Navojoa, Mex., on the Cananea, Yaqui River & Pacific, southeast to Guadalajara, about 720 miles. About 40 miles was finished from Navojoa, south, and work is progressing on other sections of the line.

Morgan's Louisiana & Texas.—On the extension from Lafayette, La., to Port Allen (opposite Baton Rouge), about 21 miles is finished and work on the remaining 32 miles is in progress. On the extension from Bayou Sale to South Bend, about 11 miles, grading is finished.

Louisiana Western.—On the extension from Eunice, La., to Mamon grading is finished on about 10 miles and work under way on the remaining seven miles.

Other improvements during the year include: second main track on the Pacific system between Burbank, Cal., and Los Angeles, 8.10 miles. The 15 miles between Elvas, Cal., and Roseville will probably be finished early in 1908. Work is under way on three miles between Shriever, La., and Thibodaux. About 24.75 miles of narrow gage was changed to standard. Work is also under way on a change of line near Palisade, Nev., on 1.48 miles of main track where the line is to be shortened; also near Santa Barbara on 1.60 miles of main track and second track.

Union Central.—This company, it is said, has announced that work on its main line from Dallas, Tex., to New Orleans is to be started this month and pushed to completion. The first section to be built will be from Dallas to Irondale, 60 miles. A branch is already finished from Irondale to Wortham, 30 miles. The office of the company is at Dallas. W. J. Hogue is President.

RAILROAD CORPORATION NEWS.

Detroit, Toledo & Ironton.—Thomas D. Rhodes, of New York, formerly receiver of the Detroit Southern, has been appointed a third receiver of the Detroit, Toledo & Ironton on the application of the Knickerbocker Trust Company on behalf of security holders in New York. Officers of the railroad were appointed as the first two receivers.

Great Northern.—The approximate gross earnings for January were $3,316,130, an increase of $769,604. For the seven months ended January 31, gross earnings were $38,006,974, an increase of $4,885,204.

Illinois Central.—Decision is to be given on February 20 on the right of E. H. Harriman to vote 281,231 shares of Illinois Central stock held by outside corporations, principally by the Union Pacific.

Louisville & Nashville.—Gross earnings for December were $3,358,000, against $4,053,000 in 1906, a decrease of 17 per cent. Net earnings were $379,000, against $1,371,000 in 1906, a decrease of 72 per cent. For the six months ended December 31, 1907, gross earnings increased 3 per cent. and net earnings decreased 22 per cent. The 1906 figures are revised so that the comparison is not vitiated by the Interstate Commerce Commission's classification of earnings and expenses in use since June 30, 1907.

This company has issued a circular to its stockholders, giving information about the Louisville Property Company, in whose stock an extra dividend of 1 per cent. was paid this week to Louisville & Nashville stockholders. The Louisville Property Company is a Kentucky corporation whose entire capital stock, amounting to $50,000, was owned by the Louisville & Nashville. It held many tracts of land adapted to the uses of the railroad and also considerable bodies of coal lands, chiefly in Kentucky. Because of the provision of the Rate Law against transportation of coal in which a railroad has an interest direct or indirect, the close relations between the two companies were severed by dividing the railroad's interest in the property company among the railroad's stockholders. To this end the capitalization of the property company was increased from $50,000 to $600,000 and certain conveyances of land were made in order that the large indebtedness of the property company to the railroad company should thereby be reduced. "It is believed that the shares of the Louisville Property Company are reasonably worth their par value, if not more."

Norfolk & Southern.—J. F. Pierson, Jr., & Company, New York, are offering at 94 and accrued interest, netting about 8½ per cent., $500,000 of the $2,750,000 three-year 6 per cent. collateral trust notes dated November 1, 1907, and subject to call at 102½ and interest. First and refunding mortgage 5 per cent. bonds are reserved to retire these notes, which are secured on $2,040,000 general mortgage 5 per cent. bonds, $1,200,000 5 per cent. equipment trust bonds and $1,000,000 first and refunding mortgage 5 per cent. bonds. The notes were issued to provide funds for finishing the new construction connecting the various lines of the company and for working capital.

Phillips & Rangeley.—See Sandy River.

Sandy River.—There is a report that the Phillips & Rangeley, which runs from Phillips, Me., to Rangeley, 29 miles, and has been for two years in the hands of a receiver, is to be freed from its receivership and merged in the Sandy River Railroad, which runs from Farmington, Me., to Phillips, 18 miles. The Sandy River has acquired all the outstanding bonds of the Phillips & Rangeley and of the Eustis Railroad, which runs from Eustis Junction to Berlin Mills Camp, 15 miles, and the Madrid Railroad, which runs from Madrid to a point in Township No. 6, six miles, both of which are operated by the Phillips & Rangeley. All these roads are 2-ft. gage railroads; their business is principally lumber.